(416)

RESTRICTED

Distr.
GENERAL

UNCTAD/ITP/46
1 November 1990

ENGLISH ONLY

UNITED NATIONS CONFERENCE ON TRADE AND DEVELOPMENT

STRUCTURAL CHANGES IN THE AUTOMOBILE AND COMPONENTS INDUSTRY DURING THE 1980s WITH PARTICULAR REFERENCE TO DEVELOPING COUNTRIES

Study prepared by the UNCTAD secretariat

The designations employed and the presentation of the material in this document do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations concerning the legal status of any country, territory, city or area, or of its authorities, or concerning the delimitation of its frontiers or boundaries.

GE.90-55973/2581B

Foreword

In November 1989, the UNCTAD Committee on Manufactures decided, in paragraph 7 (a) of its decision 14 (XII), to consider in its future work:

"Trends and features in the demand for, and supply of, manufactures and semi-manufactures, including changing patterns of comparative advantage, market access and export supply aspects in specific sectors of current and potential export interest to developing countries, taking into account work being carried out elsewhere in UNCTAD and the United Nations system".

This study forms part of the secretariat work programme in response to the Committee's request to the Secretary-General of UNCTAD "to prepare documentation as appropriate, to enable the Committee to consider these issues at its next session" (ibid., para. 8).

CONTENTS

	Paragraphs
Summary and conclusions	(i) - (xi)
I. Structural change in international trade and production ...	1 - 32
A. Global shifts	1 - 3
B. Foreign trade	4 - 20
C. Production	21 - 32
II. Pressures for structural adjustment	33 - 49
III. Adjustment policies	50 - 91
A. Government policies and corporate strategies in developed countries	50 - 74
B. Structural change in developing countries	75 - 91
IV. Prospects for developing countries	92 - 100
Statistical Annex	

Summary and conclusions

(i) The decade of the 1980s was a decade of major structural change for the automobile industry. Major overcapacities, alternating swings in consumption patterns, and drastic change in production technologies, management, organization and corporate strategies redistributed the world patterns of production and trade in this industry.

(ii) The major structural changes took place among developed market economies: shifts in production and trade moved primarily from traditional producers in the United States, the United Kingdom and France towards Japan, the Federal Republic of Germany and southern European producers.

(iii) Since the upswing of car demand in developed countries of the mid-1980s, the North-South dimension of structural change also gained considerable momentum. Some industrially advanced developing countries succeeded in expanding rapidly their exports of cars and components to major developed-country markets. The structure and composition of these export dynamics, however, varied widely.

(iv) Export growth for passenger cars was spectacular, but highly sensitive to changes in demand: a rapid rise of developing countries' car exports to the North American market was followed by a drastic decline, when the automobile business slowed down in 1989. Exports are highly concentrated on four developing countries, with a recent surge of new exporters to individual developed-country markets. Exports of parts and components grew less spectacularly, but more steadily, and they can be engaged by a broader range of developing countries from all regions. Only in a few developing countries has the expansion of exports exerted a major impact on production and employment in the industry. In others, rising exports only compensated for the contraction of domestic demand.

(v) The strong pressures for adjustment felt by the automotive industries of certain major developed producer countries were mainly due to delayed adjustments to changing consumption patterns, new production technologies and radically renovated standards of the organization and management of car production. Developing countries' export growth did not act as a major spur in this process: their gains in market shares were minor in comparison to the shifts recorded between major developed-country producers. Furthermore, a large portion of their exports were marketed by major transnational corporations (TNCs) in consistency with their corporate strategies. Such trade contributed rather to strengthening the TNCs' international competitiveness.

(vi) The response by developed countries to these adjustment pressures took in part the form of government assistance to the rationalization and modernization programmes of their companies. But several developed countries also relied heavily on selective import protection against major foreign competitors, fairly comprehensive government aids and other forms of investment and industrial subsidies to conserve their automotive industries.

Such measures provided a breathing space to the industry to enable it to undertake necessary modernization investments. But they failed to avoid a major contraction of employment and to put production back on a path of dynamic growth. Both, government aids and protectionism delayed the adjustment process and proved costly to consumers and expensive for the budgets of developed countries. They also had important external effects as they reduced the scope for global specialization and focused new foreign investments on those markets where protectionist pressures were highest.

(vii) Developing countries' export dynamics were largely founded on intensified co-operation with foreign partners within a rising number of export-oriented joint ventures, production licensing, sub-contracting and export marketing arrangements, as well as TNC subsidiaries. Changes in corporate strategies of major car producers in developed countries facilitated this trend, as they moved towards global specialization of production. Policies of developing countries vigorously stimulated rationalization and exports of their automobile industry through determined sectoral investment and production policies. They are now entering a follow-up phase of gradual liberalization of sectoral investment and industrial regulations and import protection; in parallel, they are strengthening their functional and macro-economic policies to raise international competitiveness throughout manufacturing industries.

(viii) Successful exporting countries were thus able to develop an automotive industry, where several factors point to the potential for future success. These countries were able to avoid excessive fragmentation of production by brands and models and several of their enterprises have production runs which come close to those of smaller Japanese or European competitors. They possess relatively modern plants and equipment and have gradually introduced automated and flexible production and robotization. Availability of qualified labour as well as low labour costs remain an essential asset in the automotive industry of developing countries, though recent rises in exchange rates and labour costs have diminished the differential of major East Asian producers.

(ix) Future prospects for car exports by developing countries hinge on their capacity to develop and adjust their products continuously to the rapidly changing consumption patterns and international quality, environmental and technical standards. If success is to last, they ought in particular to diversify and upgrade the range of their offer, and to diversify their markets, in order to reduce their present extreme dependency and vulnerability. The building-up of an independent design and technological capacity, as well as of their own export-marketing network, would enhance consumer-closeness: the capability to perceive and react at an early stage to changes in major markets is all the more important, as volume growth of North American and European markets is likely to be slow and as international competition is heightening again. In view of these exacting requirements, large-scale exports of cars are likely to remain limited to a narrow range of developing countries with a large, solid and dynamic domestic market base and with companies possessing substantial technological, financial and export marketing capacities.

(x) Production and export prospects are more dynamic for car parts and components, as world demand is growing faster and labour cost advantages are more decisive. Tightening international competition is likely to stimulate major TNC car producers to decentralize production and to search for low-cost partners for sub-contracting labour-intensive components. This trend increases also the chances for developing countries, in particular those which are geographically close to major developed countries, to become partners for production or sites for relocation. On the other hand, a stronger reliance on independent component producers in developing countries for indirect or direct exports and international sub-contracting requires in many instances a substantial upgrading of technological and quality standards.

(xi) While governments and firms of developing countries can still considerably improve conditions for growth of production and exports of their automobile industries, there is also substantial scope for strengthening international co-operation at the level of firms and governments in that industry. Governments of developing countries can act on various operational, financial, infrastructural and fiscal conditions to improve their attractiveness for foreign firms. They may target their measures at desired forms of co-operation, such as export-oriented joint ventures, technical co-operation, licensing and management contracts with independent local enterprises or sub-contracting arrangements. Such conditions are particularly important in the component industry, if a country wants to attract small and medium-scale enterprises from established producer countries, which may become flexible but sensitive partners. Major TNCs and domestic car assemblers can also make an important contribution to the development of the components industry through intensive in-house training programmes, the joint development of products, or assistance to rationalize production and increase productivity. Close co-operation at governmental level between developing countries and major car-exporting countries can improve the framework for co-operation at the enterprise level, promote joint-venture arrangements, reduce the risk factor and facilitate risk capital financing. Developed countries can in particular support such co-operation by offering liberal and stable market access, undisturbed by administrative barriers, safeguards and anti-dumping action, to support longer-term investment in export-oriented co-operation.

I. STRUCTURAL CHANGE IN INTERNATIONAL TRADE AND PRODUCTION

A. Global shifts

1. During the 1980s, the international automobile industry was characterized by marked shifts in international market positions, production and investment among the major developed country producers. At the same time, a small number of industrially advanced developing countries arose as important exporters of cars and components.

2. During the earlier years of the decade, structural change coincided with a heavy recession of the industry in North America and most of Western Europe. During that first phase, all major shifts in production and trade occurred within the developed countries, whose overall shares as a group in world totals remained by and large unchanged: while certain countries, such as Japan, Spain and Canada succeeded in expanding their exports and market shares rapidly, other traditional producers, such as the United States, the United Kingdom, France and Italy stagnated or lost significant shares in world exports. As from 1984, the automobile industry experienced sustained recovery and growth, which slowed down in North American markets by 1989. During that period some of the earlier trends were reversed. Export expansion came to a halt in Japan, and partially also in Canada, while France, Italy and the United Kingdom recuperated much of the lost ground. The United States, however, continued to lose massive shares in world export markets.

3. The rapid expansion of developing countries' exports to world markets was a second major feature during the recent phase of growth. While during the first half of the 1980s the share of developing countries fluctuated around 2 per cent, their exports to world markets quadrupled between 1984 and 1988 and raised their share in world exports to 4.3 per cent. Developing countries achieved a rate of export growth of 20 per cent per annum for the sector (in value terms). The size of this share as well as the dimension of change are still small in comparison to the dominating position of developed countries, whose mutual trade still accounts for the overwhelmingly greater part of trade in this sector. But the export success has been highly important from the point of view of the developing countries concerned. The automobile industry has become one of the most dynamic export sectors of developing countries as a group during the 1980s; and this sector became one of the top-ranking exporters in some industrially advanced developing countries such as the Republic of Korea, Mexico, Brazil and Yugoslavia.

B. Foreign trade

4. Trade dynamics did not affect all product groups within the automotive industry in the same manner. Passenger motor cars have been the most dynamic sector in world trade during the 1980s: trade more than doubled (+ 10 per cent per annum) and now accounts for about half of sectoral exports. Trade in commercial vehicles is far less intensive and showed little dynamism: their exports rose by about one third only, and their share decreased to one eighth of sectoral trade (see tables 1 and 2).

5. Relative country positions for exports of passenger motor cars shifted drastically. As a result of significant gains in export shares, Japan now ranks top among car exporters (about 30 per cent of world exports), followed by the Federal Republic of Germany (which maintained a strong position of about 23 per cent). All other major traditional car exporters among the developed countries lost significant export shares over the 1980s or stagnated: Italy, France, the United Kingdom, the United States and Canada now participate with only 2 per cent to 8 per cent in world exports, which is far below their importance as car exporters in the 1970s. Losses on their traditional developed-country markets coincided with losses in overseas exports (see table 2).

6. The vehicle parts industry achieved worldwide almost as rapid export growth as did passenger cars (+ 9 per cent per annum between 1980 and 1988) (see table 3). Exports of two main branches - car engines and "bodies, chassis and other parts" 1/ - correspond to three quarters of passenger car exports. But an important portion of automotive parts, components and accessories is provided largely by other industries, such as electrical and electronic components and accessories, rubber tyres and tubes, glass, etc. (apart from raw materials from the steel, textiles, plastics, metal and other industries). These "extra-sectoral" parts correspond to about an additional quarter of the two above-mentioned major groups of car parts and components. Exports of "bodies, chassis and other parts" were the most dynamic subgroup and followed by and large the growth rate of vehicle exports; global export growth of engines, as well as of extra-sectoral parts fell sometimes considerably short of this performance.

7. Japanese exports of vehicle parts and components became more dynamic and enlarged substantially their market positions as Japanese expansion strategy shifted from vehicle exports to overseas production: export shares for complete cars reached their turning point in 1987 and have started to decline since then. Over the 1980s, Japan tripled its components exports and doubled its market share, which reached 13 per cent in 1987. Other developed countries maintained strong market positions in this sector, as well; in particular the Federal Republic of Germany, which took over the position of the world export leader from the United States (see table 3).

8. Developing countries achieved their major export success in the exports of passenger cars: their export value rose by 35 per cent per annum between 1980 and 1988 to over $US 5.5 billion. As a group, developing countries' exports now exceed those of the United Kingdom. Exports of engines achieved similar results. Exports of car parts rose less, but still faster (by 20 per cent per annum) than those of developed countries. On the other hand, exports of trucks, once important, stagnated and those of buses declined substantially over the 1980s. Altogether, commercial vehicles now account for no more than 5 per cent of total sectoral exports of developing countries.

9. Car exports are highly concentrated on a few industrially advanced countries. The Republic of Korea and Mexico accounted in 1987 for four fifths of total developing-country exports, followed by Brazil and Yugoslavia. The Republic of Korea is on the way to catching up in size with some smaller European car exporters. Car exports of these major countries are highly

dependent on the North American car market, which absorbed about three quarters of them, but slumped drastically in 1989. Car exports by the major exporters to other developed countries remained until recently comparatively small and underdeveloped, with few exceptions such as Brazilian car exports to Italy and Yugoslav exports to the Federal Republic of Germany, France and Italy. Most car exporters have, however, undertaken efforts recently to diversify into new markets, in particular in Western Europe. A few new developing car exporters have also tried to enter world markets more recently: Taiwan Province of China, Malaysia, India, Turkey, Argentina and Thailand partly focus initially on North American markets, partly on individual European markets. Their export sales are still relatively limited and consist frequently of only a single small-sized car model. Developing-country markets on the other hand absorbed only about 5-10 per cent of total exports of major exporters in 1987/88. Exports to the Latin American Economic Integration Association are, however, an important market outlet for Brazil (20 per cent of total car exports), and Arab countries are of some importance for car exporters of the Republic of Korea.

10. The four major developing car exporters also dominate exports of parts and components (see table 3). Latin American suppliers, where automotive industries and independent component producers have already longstanding experience, are the leaders in this trade. The highly dynamic exports of car engines originated mainly from Brazil and Mexico, and to a lesser extent from Yugoslavia, the Republic of Korea and Taiwan Province of China. Exports of other automotive parts and components have been growing in a less spectacular but steadier manner than cars and engines. They have also been accessible to a larger number of developing countries from all regions. In addition to the four major automotive producers, several other developing exporters achieved exports ranging between $US 10 million and $US 100 million in 1987/88: Argentina, Chile, India, Morocco, Philippines, Taiwan Province of China, Thailand, Tunisia, Turkey and Venezuela. With few exceptions, these sales have also been highly dynamic.

11. The export success of developing countries for cars was only achieved after several, less successful attempts to other world markets. Present trade is still highly volatile and sensitive to fluctuations of consumption in major markets as well as to reactions by market leaders to the export success of newcomers. Recent economic and labour problems and steep price increases in the Republic of Korea, Yugoslavia and certain Latin American countries have also had a drastic effect as they resulted in substantial losses of markets gained earlier in the United States. Over-concentration of car exports on single models and single markets contributed strongly to the vulnerability of export sales for cars. A too rapid expansion concentrated on a single market also raises protectionist pressures by domestic industries. On the other hand, exports to less saturated European and Asian markets still offer substantial potential for further diversification and growth.

12. Export increases were mainly achieved through intensified international co-operation with foreign firms in various forms. Export-oriented joint ventures, production licensing and technical co-operation, export marketing contracts and international sub-contracting with domestic enterprises of developing countries have gained ground rapidly in the recent past in this industry, besides traditional TNC subsidiaries.

13. Car exports from Brazil, 2/ Mexico 3/ and Taiwan Province of China are mainly carried out by and within major TNCs of the international automobile industry. In the Republic of Korea, 4/ forms of international co-operation are more diversified: in two cases, foreign TNCs conduct exports of jointly developed car models produced within joint venture arrangements. The third and major Korean car producer and exporter co-operated for car design with a foreign partner but produces independently (within a minority joint venture), and has developed its own export marketing and sales network overseas. The major Yugoslav 5/ car exporter has in the past been relying mainly on licensing and technical co-operation agreements with foreign partners and has produced and exported cars independently. Many other enterprises in developing countries endeavouring to enter export markets have also established firm joint venture or contractual relations with major foreign car exporters.

14. The bulk of developing countries' exports of car engines also consists of intra-TNC trade in order to complement domestic production deficits or to rationalize and reduce production costs within the company as a whole. International co-operation is also at the root of an important part of export growth of car components: many exports from Latin American countries are related to the United States or Western European TNCs. In the Republic of Korea and Yugoslavia co-operation took rather the form of numerous contractual and joint-venture arrangements with domestic component producers, some of which are rapidly expanding their exports.

15. By 1987/88 components exports have become more important than car exports for most developing countries engaged in this trade. Only in the Republic of Korea do car exports dominate largely an incipient export production of motors and other components (and account for 95 per cent of sectoral exports). Motors and components account for half of sectoral exports of Brazil, close to 60 per cent in Mexico and Yugoslavia and even for substantially higher percentages in the other developing countries. For many developing countries, as well as smaller developed countries, parts and components production offers a realistic opportunity for participating in the automobile sector and for developing exports to world markets.

16. In spite of the high density of car registrations and signs of saturation in some developed countries, they continue to provide the main dynamic markets for automobiles and components. Over the 1980s, their importance has increased even further, as imports into socialist countries stagnated and imports into developing countries even decreased. Consequently, the share of developed countries in world imports rose from 75 per cent to 80 per cent between 1980 and 1987. The United States market has been by far the most dynamic and largest import market for cars and vehicle components of all types (see table 4). Canada, the Federal Republic of Germany, the United Kingdom, France and other EEC countries follow far behind, and with varying growth performances. Imports by Japan have been very small in comparison to income and the importance of the car industry in that country: while growing rapidly over the past few years, car imports do not yet exceed the size of smaller European countries, such as Austria or the Netherlands. Japanese imports of parts and components are marginal: in spite of recent fast growth, they correspond to less than 5 per cent of Japanese component exports. In 1988 they were of the same size as component imports of a small European non-car producer such as Switzerland. Japanese imports of car engines equalled those of Hong Kong or Ireland.

17. Regional trading patterns are heavily biased by government policies (see table 3). Car trade has been widely controlled by most developed countries during the 1980s, especially vis-à-vis Japan. Japanese import shares are particularly low in France, Italy, Spain and the United Kingdom. Regional import patterns also reflect the impact of regional agreements, as mutual trade is exempt from quantitative controls and tariffs: intra-European trade (EEC and EFTA) constitutes between 80 per cent and 95 per cent of total imports of major EEC countries. As a result of the longstanding mutual preferential arrangements in the automobile sector between the United States and Canada, mutual trade is also largely directed to each other's markets.

18. Developing countries' shares in the value of car imports of developed countries as a group remained fairly marginal in most developed countries (0.1 per cent in Japan; less than 1 per cent in most European countries, but 2.4 per cent in the United States and about 4 per cent in the Canadian markets). Their market shares for cars in Western Europe and the United States rose from 2 per cent in 1985 to 4.5 per cent in 1987. Only half of these exports were carried out under own brand names and within own marketing channels by two Republic of Korea and Yugoslav companies (Hyundai and Zastava). They were largely geared to the United States market, where they achieved - in terms of car registrations - shares of 2.5 per cent and 0.3 per cent respectively in 1988 6/ (but substantially less since then). Apart from Canada, import penetration remained marginal in most other developed markets; about 1 per cent in the United Kingdom and Netherlands and even less in France, etc. As their exports consist mainly of smaller cars and as United States producers had for long abandoned this market segment to Japanese and European producers, the products of these two companies do not enter into direct competition with United States domestic production. For this reason, they hardly contribute to adjustment pressures in this country. Nor do the other exports of cars and motors which took place between TNC subsidiaries and their parent companies (in the case of Latin American exports) or within joint venture-cum-export marketing arrangements between other Korean firms and TNC partners, as they form part of worldwide corporate strategies to improve international competitiveness.

19. Developing countries acquired some significant import shares for engines (23 per cent) and other parts and components (10 per cent) in the United States market: the two main suppliers, Mexico and Brazil, also hold, together with Taiwanese and Yugoslav suppliers, 2 per cent - 3 per cent shares in imports of other components markets.

20. Developing country markets failed to fulfil the high expectations set in the 1970s in their potential for growth of production and trade. Adjustment needs and policies exerted a strong negative impact on automotive imports: their value shrank by 20 per cent, and their share in world imports slumped from 23 per cent to 10 per cent between 1980 and 1987. This recession affected all developing regions and lasted almost throughout the period under review. Only the South-East Asian region reversed this trend and resumed import growth as from 1987. Two factors contributed to this recovery: favourable dynamics of overall economic growth in the region and progress towards import liberalization in some countries and territories, in particular the Republic of Korea and Taiwan Province of China. Other major importers include Saudi Arabia and other Gulf countries on the one hand, as well as a number of producer and assembly countries, where imports consist mainly of parts and components: Mexico, Brazil, Turkey, Yugoslavia, Indonesia, Thailand, etc.

C. Production

21. Growth of world production in the automotive industry as a whole was slow during the 1980s. It reached only about 2 per cent per annum on average for passenger cars between 1980 and 1988, and even less for the industry as a whole. Changes between the main country groups were small: while developed countries maintained their dominant position (about 88 per cent of world production) throughout that period, developing countries increased their share from 5.2 per cent to about 6.5 per cent, mainly during the latter part of the period. The share of countries of Eastern Europe in world production fell from about 7 per cent to 6 per cent.

22. This relative stability of overall trends and shares veils, however, the tremendous changes, which took place in production and employment of individual countries, in particular during the initial phases of recession. Between 1978 and 1982 production of the automobile industry dropped by about one third in the United States and Canada, by about one sixth in the United Kingdom and stagnated in France and Italy. North American production has since recuperated its earlier levels and grown further. In the three Western European countries, production of the automobile industries only recovered recently: France and the United Kingdom have hardly reached as yet their peak production level of the late 1970s; Italy's production started to rise again as from 1986 (see table 5).

23. On the other hand, Japan, the Federal Republic of Germany, Spain and some smaller European producers achieved substantial production growth over the 1980s. In several cases, such as the German and Japanese automotive industry, real growth of production (value added) exceeded growth in numbers of cars produced as there has been a distinct trend towards higher-value cars: production shifted to larger and more comfortable cars, as well as improved safety and environmental equipment. 7/

24. The performance of automobile industries of developing countries was as heterogeneous as that of developed-country producers: rapid growth of the industry in the Republic of Korea, with annual average increase rates of about 17 per cent between 1977 and 1986 and respectable growth rates of about 4 per cent per annum in two other major producers, Yugoslavia and India, during that period contrast with substantial recession until the mid-1980s in most Latin American producing countries (see table 6). Production was also weak in most countries which have only assembly operations: owing to a combination of curtailed internal demand, major exchange-rate realignments and high import contents, assembly operations became economically inefficient in certain countries, so that several assembly lines have even been abandoned.

1. Passenger cars

25. As in the industry as a whole, the major shifts in production occurred among the developed countries. While total car production in unit terms rose only little between 1978 and 1988, the Japanese share in DMEC production rose drastically from 21 per cent to 27 per cent, at the expense of North American production, whose share dropped from 36 per cent to 27 per cent between 1978 and 1988. EEC maintained its leading position unchanged (about 44 per cent in 1988) (see table 6).

26. In addition to these direct shifts of production, there has also been a major expansion of Japanese overseas production mainly in the United States, the United Kingdom, Canada and Spain. Japanese car production in the United States quintupled between 1984 and 1988 when it reached a 10 per cent share in total production. Substantial investment in new production capacity is under way which will bring large additional production on stream in the near future. Japanese production in Canada has reached 5 per cent by 1988 and is also going to expand. Japanese car producers have also made major investments in the United Kingdom, and a number of new plants are being planned for the near future: production started in 1988 with about a 4 per cent share. In addition to direct foreign investment, joint ventures and other co-operative arrangements between Japanese and United Kingdom producers have also been established on a significant scale. 8/

27. Developing-country production of passenger cars only took off significantly as from the mid-1980s; after having remained stable for a long period, car production rose by one half between 1985 and 1988. Besides the four major exporters, Turkey, Argentina, India and Taiwan Province of China have also attained significant scales of domestic car production, followed at some distance by Malaysia (see table 6). The dynamics of car production have, however, been as heterogeneous as among developed countries. The Republic of Korea accounts for the bulk of the production increase: in this country the rapid export success coincided with an appreciable rise in domestic consumption. In Latin American countries, car production has still not reached its record levels of the early 1980s again: the dynamic export expansion of Mexico and Brazil has still not fully compensated for the severe recession of domestic demand which took place in these and other countries of the region. 9/ Car production was also expanding in Yugoslavia, India, Turkey, Taiwan Province of China and Malaysia.

28. During the 1980s, developing countries' car production turned from domestic markets towards outward orientation, either as an effect of deliberate corporate and national policies (such as in the Republic of Korea) or as a result of a combination of such measures with the effects of recession of domestic consumption (such as in Brazil and Mexico). Between 1980 and 1988 the export quotas of developing countries' vehicle production rose from 20 per cent to 67 per cent in the Republic of Korea; from 17 per cent to 37 per cent in Brazil; from 22 per cent to 31 per cent in Yugoslavia; and in the most spectacular case of Mexico, from 4 per cent to 41 per cent. They thus approached export production ratios comparable with major developed country exporters such as Japan, the Federal Republic of Germany, Spain and France, which range between 50 per cent and 60 per cent. Similar efforts to increase the export orientation of car production are also under way in a number of other developing countries and territories, such as Turkey, Taiwan Province of China, India and Malaysia.

2. Parts and components

29. The role of parts and components production within the total car industry shows a growing trend in major developed countries. In 1987 total sales of this subsector accounted for example for about 30 per cent of overall sales of the European motor vehicle industry: original equipment parts account for 60 per cent of turnover (while replacement parts constitute the remaining 40 per cent). The export market is very important for EEC's production,

which achieves a 60 per cent export ratio and a major surplus in trade with third countries. The current value of Community production grew by about an average annual rate of 7 per cent during the 1980s. Japanese production of auto parts grew at a rate similar to that of the Community of close to 8 per cent per annum (1980-1988): in that country a much higher share of production is however directed to "original equipment manufacturing" (OEM), i.e. 80 per cent, whereas only 20 per cent are used for replacements. The Japanese components industry exports only about one eighth of its production but it achieved a major trade surplus. Furthermore, the Japanese car industry, while moving new investment and production abroad, has stimulated Japanese component producers to follow suit and establish themselves on major foreign markets: a number of Japanese vehicle part producers have established themselves in the North American region. Others are actually in the process of establishing joint ventures with local companies or foreign subsidiaries in the United States, EEC or neighbouring countries.

30. Traditionally, developing countries' production of vehicle parts had been mainly oriented towards the needs of domestic car assembly and replacement markets. Major Latin American producer countries possess a well-established components industry. On the one hand, there are a number of independent part producers which benefited from tight local contents requirements, which effectively raised the degree of national value added in TNC car production; from limitations imposed on TNC subsidiaries with respect to their own vertical integration and from incentives for TNCs to export local components. On the other hand, TNC subsidiaries established local engine production on a scale which rendered exports to world markets economically feasible. The recession of domestic demand for cars also acted as an incentive for independent car producers to intensify direct exports more recently.

31. Car production in the Republic of Korea relies at least partially still to a large extent on imports of major components from Japanese producers, with whom they are also linked by equity participations. Only one of the three major producers/exporters has so far achieved a relatively high degree of vertical integration. But the local vehicle parts industry is rapidly expanding, and major car producers are also extending their vertical integration fast. 10/ Several parts producers also entered into a rapidly expanding number of joint venture and licensing arrangements with foreign companies, with the aim to upgrade technology, quality and competitive positions vis-à-vis domestic car industry and to reach production scales which render them competitive in direct exports. Over the 1980s, total sales of the components industry have grown at a rate of 36 per cent per annum, mainly on the account of the rapid expansion of the domestic car industry: about 80 per cent of production consists of OEM which implies that more than half of components production is exported indirectly to third countries via finished cars. The components industry has also expanded its direct exports at a rate of 26 per cent per annum, albeit from a low starting level. Direct exports of parts by this industry reached in 1986/87 about 10 per cent of total exports of the automobile industry. 11/

32. Components production has also been expanding as a result of increased sub-contracting in a number of other developing countries in South-East Asia, Central America, and the Mediterranean region more recently. Not only Japanese, but also Korean, European and United States enterprises are increasingly resorting to this mode of production in low-wage developing countries.

II. PRESSURES FOR STRUCTURAL ADJUSTMENT

33. The adjustment needs for North American and European car industries arose in the main from major technological change and a combination of new productivity standards and production organization underlying the breakthrough of Japanese producers in international competition.

34. At the beginning of the 1980s there was a wide productivity gap between Japanese producers on the one hand and their United States and Western European competitors on the other. While the former had succeeded in reducing the number of hours required for producing a car to about 140, United States and German producers required about 200 (these levels have since been improved by all producers). 12/ Production cost differentials arose mainly from automatization and a rigorous modernization of managment of production and organization of labour. The introduction of robotization and automatization in major assembly operations has substantially reduced direct labour and turned the automotive industry, which had earlier been considered as labour-intensive, into a capital-intensive industry. For car production, labour costs account now for about 20-22 per cent of total production costs on average in major developed countries. Japanese organization of production streamlined procurement of parts and components, the intra-firm product flow from parts to the finished products and eliminated stocks and idle time during the production process. Other radical differences concerned the organization of work from chain operations to group work; and intensive training of workers to enable them to perform multiple operations and quality control functions. Additional costs were rapidly amortized by quality gains and savings in supervisory and control staff.

35. Further major competitive advantages arose from increased emphasis on strict quality standards. Computerization and the new production organization enabled producers to improve flexibility of production and design of new car models. They reduced the economic threshold for scale economies and rendered shorter production runs economically feasible. Furthermore, the time required for launching new car models was reduced significantly.

36. The pressures for adjustment were reinforced by high overcapacities of production in North America and Western Europe, as the Japanese breakthrough on export markets coincided with a major recession of consumer demand in that industry. In addition, the petroleum crisis of 1979 brought about a major shift in demand towards smaller cars, now reversed again - a change which had caught United States car producers unprepared. Between 1978 and 1982 car registrations contracted by about 30 per cent in North America and remained below 1978 levels virtually throughout the 1980s (see table 7). European demand also stagnated during a long period, but recovered again as from 1984: the modest 2 per cent average annual growth rate of car registrations is mainly due to the dynamics of Southern European countries and the United Kingdom. While the density of cars per inhabitant has virtually reached saturation point in the United States, and came close to that level in the Federal Republic of Germany, there is still scope for further expansion in several other EEC countries, where the number of passenger cars per inhabitant is substantially below peak levels (see table 8).

37. By contrast, internal consumption provided an important support to the growth of the Japanese automobile industry, as it expanded on average at about 3.5 per cent per annum over the past 10 years. There is still substantial scope for further growth on that market, as car density remains comparatively low if compared with the income level of Japan: it reaches less than half of the United States density, or about the ratio of Spain.

38. The strength of the competitive position of Japanese car producers was demonstrated by their rapidly rising shares in the North American and European markets. Increased import pressure from Japanese cars raised in turn substantial protectionist reactions and limited further import penetration in several major markets. Import penetration by Japan reached 20 per cent in the United States; if local production of Japanese cars is added, its total market share rises to 24 per cent. Japanese import penetration was lower in Europe: it reached 15 per cent in the German market, 11 per cent in the United Kingdom, but only 3 per cent in France and 1 per cent in Italy, the two most tightly controlled markets for Japanese cars.

39. Interpenetration was also very high at the regional level in Europe. Intra-EEC trade reached about 40 per cent of total car registrations, while the market share of extra-regional imports decreased from 14 per cent to 11 per cent between 1985 and 1988. 13/ This high rate of mutual interpenetration maintained a strong competitive pressure on the car industry even in the presence of high protection against Japanese imports in certain member States. The high degree of mutual interpenetration of the United States and Canadian car industries consisted on the other hand mainly of intra-company trade; it served mainly corporate policies of increasing efficiency rather than introducing a larger degree of competition into the oligopolistic market structures. European producers tended to lose ground in the North American markets. Import penetration by developing countries remained marginal and did not exert major pressures for adjustment.

40. Further important pressures for adjustment affected all world market producers:

- rapid technological progress with respect to the product and the production technology;

- high demand on the industry with respect to developing responses to pressures for increased safety, energy savings and environmental protection.

41. Structural change did not spare Japanese production either. While until the mid-1980s exchange rate developments rather tended to accentuate Japanese price competitiveness on the United States and major European markets, this situation was drastically reversed with the sharp appreciation of the Japanese currency. Japanese car exporters had to cope with an abrupt doubling of their dollar prices between 1985 and 1987. Furthermore, rising protectionism in major import markets limited the possibilities for expanding production through exports. 14/

42. Developing countries which wanted to pursue export strategies were subject to the same pressures on modernization of their car industry with respect to products, production organization, equipment and production technologies. The challenges involved in tightened productivity standards, high levels of automatization, stringent requirements in respect to quality and management were strongly resented by developing-country producers, which had for a long time been mainly producing for protected domestic markets.

43. Furthermore, most developing countries have been facing problems with regard to the splitting of limited domestic markets into too many models of too many producers. Unless countermeasures were developed, short production runs rendered export plans unfeasible even in larger developing countries.

44. Similar pressures for adjustment extended to the vehicle parts industry of Western Europe and the United States as an extension of the new management and organizational standards introduced in the car industry. These standards imply a much closer co-operation between car producers and component suppliers. To ensure continuous production flows and allow the elimination of stocks at car plants, just-in-time delivery is requested increasingly from part producers at the rhythm of car production, i.e. at a high frequency and up to several times per day. Often responsibility for quality control is shifted to part producers. There is a trend towards supplies of complete sub-sets rather than individual parts, which facilitates assembly operations and use of industrial robots. Initiatives for technological development and research are increasingly left to the part suppliers. As a result, both responsibilities and risks have been largely shifted towards components industries.

45. In turn, many car assemblers have withdrawn from production of certain components by themselves, and thus enlarged the scope of activities of independent component producers. Vertical disintegration was particularly pronounced in Japan, whose car producers depend for 80 per cent of their supplies on independent suppliers. The European car industry also buys an important proportion, varying between 55 per cent and 70 per cent, from such sources. External sourcing remains still relatively low in the American motor industry, with about 30-40 per cent. 15/ Increased co-operation involves part producers at much earlier stages of development of new car models. That co-operation is often based on longer-term contractual relationships.

46. As a result, components production turned from mere production-to-order to a much more complex management task which requires own initiatives for product development, marketing, a high degree of flexibility and increasing technical capacities.

47. Furthermore, technological change, and the need for automatization, investment in quality control and computerization also extended from the car to the component sector: a large range of new or substantially changed parts have been introduced on a large scale, such as catalyser techniques, ABS, four-wheel drive, electronic injection, computer programming, and the like. This implies heavy investments and requires the industry to be financially strong.

48. Steady growth of consumption in Western Europe facilitated the process of adjustment in the components industry: according to EEC data, apparent consumption rose at an average (nominal) rate of 7.7 per cent per annum between 1980 and 1986. This period was characterized by a rapid intensification of intra-trade, which grew almost twice as fast (13.5 per cent per annum). Import penetration from third countries remained low in that industry: rising at a rate of 10 per cent annually it reached 11 per cent in 1988. Import penetration is negligible in Japan (less than 1 per cent in 1987). 16/ The competitive position of Western European and Japanese producers was relatively strong throughout the 1980s. Like Japan, EEC has been able to raise its net export surplus continuously during the period of weak international car markets. By contrast, the United States position changed from a significant surplus to deficit: for parts and motors taken together, the export/import ratio dropped from 176 in 1980 to 73 in 1987, mainly due to a tripling of imports during that period.

49. Developing countries and territories (mainly Mexico, Brazil, Taiwan Province of China and the Republic of Korea) were able to participate in the reversal of the United States trading position: their share in imports of motors rose from 8 per cent to 23 per cent, their share of "bodies and parts" more moderately from 7 per cent to 10 per cent over that period (see table 4).

III. ADJUSTMENT POLICIES

A. Government policies and corporate strategies in developed countries

50. Governments of developed countries provided substantial support to their automotive industry. They combined protective measures with financial and fiscal support to foster rationalization and modernization by the industry.

51. Financial support took mainly the forms of concessional loans, interest subsidies and loan guarantees. Regional and local authorities also provided substantial support of this nature in many countries. Several governments, in particular in Western Europe, also supported their ailing automobile industries by outright grants, debt write-offs, and capital injections to ensure their survival. Governments of various countries, with direct involvement in nationalized industries, absorbed major losses for some time. When the cost of such policies became untenable, the enterprises were in most cases sold to other national companies such as in Italy, or to foreign transnationals as in the cases of Spain and in the United Kingdom. Plant closures were to some extent smoothed by lay-off payments (see table 9). EEC subjected exceptional approval of government subsidies to conditions for rationalization and closure of obsolete plants (as in the cases of France and Italy) and adopted a new subsidy code for the industry.

52. The major conservative policy to underpin the heavy investment in rationalization consisted of protection against foreign competition. The car market can be considered as a fairly controlled market: quantitative protection extends essentially to finished cars (passenger and commercial) and applies in most cases selectively to Japan. The main instruments are voluntary export restrictions or some form of quotas. The United States of America imposed earlier auto-limitation arrangements with Japan, whose ceilings correspond by and large to pre-existing market shares and which are still respected by Japan. The United Kingdom imposed voluntary export restraints (VERs) within an informal industry-to-industry understanding. France, Italy and Spain impose restrictive ceilings or quotas on Japanese car imports which range between 0.1 per cent and 3 per cent of annual car registrations. Portugal imposes company-specific quotas on car imports. Other countries require unilateral exercise of prudence to avoid market disruption (Canada) or impose administrative price controls to imported cars (Belgium). 17/ Developing country exports are free from quantitative import restrictions and voluntary export restraints in most major markets, with the exception of Spain and Portugal. But protectionist pressure is mounting with increasing export success. Thus, for example, Canada applied temporarily a provisional anti-dumping duty on Republic of Korea cars, which had to be revoked. This measure had nonetheless a considerable impact on curbing Korean car exports to that country. Spain recently obtained approval from EEC for limiting Korean car imports routed through other Community countries. Threats of protectionism also induced Korean car producers to increase sourcing of components in the United States of America. While not directly focusing on the automobile sector, the withdrawal of GSP concessions by United States of America from the Republic of Korea and other advanced developing countries also affect the exports of cars and components to those markets, as much as general pressures for currency appreciation. Such measures threaten to spread to other developed countries, which would not accept bilateral compromises.

53. Tariffs are relatively moderate for passenger cars and components and most developing countries enjoy duty-free access under GSP. The United States of America applies a 2.5 MFN tariff to passenger car imports; tariffs are also generally low for vehicle parts and components (0.7 per cent), but reach up to 25 per cent for trucks. Until 1988 developing-country imports had duty-free access under the GSP (subject to ceilings), but little use was made of this facility: GSP imports of car parts accounted for about 1 per cent of United States imports of such products, those of car engines for about 4 per cent. Since the exclusion of the Republic of Korea and other South-East Asian countries in 1989 from GSP access, GSP imports are likely to be further reduced. Special customs provisions for outward processing also account for only a very small share of total imports and relate mainly to operations of United States subsidiaries in Mexico and Brazil. 18/

54. Import tariffs of most other developed countries are also moderate: EEC applies an MFN rate of 10 per cent to cars and rates between 5 per cent to 7 per cent to components; GSP rates for developing countries are zero but Republic of Korea access to GSP was temporarily suspended. Japanese MFN rates are zero for cars. Most tariffs of other developed countries, such as Canada, Sweden, etc., are of similar ranges, i.e. from zero to 10 per cent, with GSP rates at zero levels in many cases.

55. Other barriers may be more effective in restricting market access: widely differing technical standards and environmental requirements; differing taxation, insurance and other costs for imported cars vis-à-vis domestic cars (which had been the case, for example, in Japan before 1989); restrictions regarding establishment of foreign subsidiaries or corporate practices. The particular structure of the Japanese market has, for example, motivated European producers of high-quality cars to establish their own subsidiaries on that market: since then their market share has expanded considerably.

56. Some developed countries also used special fiscal and financial incentives for attracting foreign investors to establish new production capacities for cars or car parts in their countries. The United Kingdom granted special subsidies under regional aid programmes to a Japanese investor in exchange for integrating the car plant with engine production. Spain, Belgium and Austria are other examples of incentives granted to new foreign investors (see table 9). 19/

57. Positive adjustment support by governments included to some extent grants and loans to research and development into new technologies. Grants and loans for major projects of that nature were extended, inter alia by the Federal Republic of Germany, France and Italy. EEC-supported technological development programmes also include projects for this sector under a cost-sharing formula between the private sector, national governments and regional EEC funds.

58. Developed countries also applied a range of more general adjustment measures to ease the shift of employees: training facilities, support to increase labour mobility, etc.

59. A major strategy to spur adjustment and productivity in the industry consists in the creation of larger regional markets: the single European Market by 1992 was mainly envisaged as a means to increase competitiveness of the European industry in high technology sectors, such as the automotive industry, and to provide a sufficiently large market base for rapid

technological advance. The Single European Market ought to bring about the removal of national quantitative restrictions and subsidies as well as accomplish the harmonization of standards at the European level.

60. On the other hand, it is likely that import controls will be converted from the national to the regional level for EEC as a whole, for a transitional period, during which the Japanese market share can only expand slowly. Similarly, the former United States of America/Canadian automotive arrangements and later the Free Trade Area are geared to increase industrial efficiency, but introduced at the same time restrictive origin requirements to distinguish North American production from assembly by foreign plants.

61. Governmental adjustment policies provided thus in all major countries a favourable framework which gave corporate policies a chance to speed up adjustments. Japanese enterprises used government stimuli to pursue a vigorous globalization strategy and continued to progress with further rationalization and technological progress. Western European and United States producers reacted to continued pressure for adjustment mainly by high investments into automation of production. Western European companies maintained throughout the 1980s very high investment ratios (ranging between 4 per cent and 13 per cent of gross output). These ratios were even superior to those of Japan (ranging between 4 per cent and 5 per cent) though most European investment during that period was devoted to rationalization as compared to the expansionist strategies of the Japanese automobile industry. By contrast, United States investment suffered severely under the recession, but recovered in recent years (see table 8).

62. Most European and North American companies adopted major aspects of management, production organization and labour organization of Japanese car producers, such as group work, just-in-time delivery of parts, elimination of stocks and waiting time, etc. North American companies established individual new plants which are fully organized along Japanese production systems, partly in United States of America, partly in Mexico. These plants showed that principles of Japanese organization can work in new environments. 20/ But these experiences have remained so far of an experimental nature, without much impact on the overall business of those companies. United States companies also acquired important minority share holdings in major Japanese car companies in order to familiarize themselves with Japanese production systems. They also entered into a number of joint ventures in the United States of America and abroad with their related Japanese car producers for co-production, and joint development of new products and technologies.

63. With few exceptions, European companies were for a long period less dynamic in searching to establish equity and other links with Japanese car producers. There was rather a tendency to concentrate on the European regional market and to reduce foreign engagement in investment and production abroad. 21/

64. Another major adjustment path intensively pursued by the United States as well as Western European producers consisted of heavy investments in research and development. Several major projects were launched to conceive future product innovations and production technologies of their own. For example, in 1988 research and development expenses of the German car industry reached about three quarters of investment in equipment and 8 per cent of gross output of the automobile industry.

65. Concentration of the industry continued further, in particular in Western Europe, through a number of take-overs of smaller car producers or mergers involving some larger nationalized companies that were in difficulty. Some inefficient plants have been closed, as well, in Europe and in the United States of America.

66. Japanese companies followed dynamic expansion strategies throughout the 1980s, first through exports, later on through foreign investment. This move was made to adjust to mounting trade barriers, to get a foothold in new large regional markets created within EEC and United States/Canadian free trade arrangements, and to become independent from exchange-rate fluctuations. Japanese foreign investment in the transport industry as a whole grew steadily and reached in 1987 about eight times the 1980 level. Almost half of cumulative investment during that period went to North America. 22/ As a result, substantial new capacities will be coming into production by 1990, to the tune of about 2 million cars in United States of America and another 600,000 in EEC. Component companies followed the major car producers with foreign investments. Sub-contracting with such companies, as well as local companies, is becoming increasingly important.

67. Certain Japanese corporations also participated in efforts to upgrade productivity of foreign subsidiaries and joint ventures. They organized to that effect large-scale training programmes, which took new staff to Japanese plants for several months to familiarize them with their production techniques. 23/ Several car producers, including those of developing countries, also made major efforts to raise components producers to a sufficient level of efficiency and quality required for export production of cars: this includes financial support, marketing support and help to acquire foreign technology for components production. Car producers were also instrumental in arranging technical co-operation and technology licensing agreements with foreign partners. 24/

68. Transfer of production to developing countries, sub-contracting and investment to secure market positions played an important role in adjustment and foreign investment strategies by Japanese companies. About one third of cumulative investment of the automobile industry was made in such countries, half in Latin America and half in Asia. New investment of United States companies had been fairly weak during the first half of the decade, when even some divestments took place. Since 1985, developing countries have again played a more important role in the strategies of major United States car companies: the bulk of these investments is concentrated on Mexico and Brazil.

69. The combined adjustment efforts of companies and governments in Western Europe and North America resulted effectively in a major restructuring and rationalization of the respective car industries. Productivity levels in North America and Europe have improved to a great extent, so that the number of hours required to produce cars has frequently come close to Japanese standards. Nevertheless, productivity levels still vary widely between individual enterprises and plants. While some have been fully automatized and little direct labour remains, others still function at relatively high labour intensity, even for volume production.

70. A 1986 EEC survey on the European Automobile Industry shows substantial disparities between member States: by that time, the French car industry had passed German productivity levels by about 10 per cent (in terms of production value per employee), while Spain and the United Kingdom lagged far behind: French performance was almost one half above that of the United Kingdom car industry. These productivity increases affect on the other hand employment: about 2 per cent of the jobs in the sector are lost each year in EEC through productivity-raising investments and major restructuring moves. 25/

71. These productivity gains resulted in a substantial reduction in employment in automobile industries in North America and Western Europe. During the recession period 1978-1982 the North American automobile industry lost about 380,000 jobs, about one third of its total labour force. In spite of recent resumption of production growth, employment reacted only very moderately. The European Economic Community lost about 220,000 jobs, or about 10 per cent of employment in that industry, during the 1980-1985 period alone. This trend has continued further since then. 26/ Even in those developed countries where production expanded over the 1980s, the labour force of the car industry remained relatively stable, and even in Japan the creation of new employment fell far behind production growth. For developed countries as a whole, employment in automotive industries remains therefore substantially below that of the end of the 1970s, in spite of recovery of production (see table 5).

72. While trade protection granted to domestic industries did not prevent rationalization, it involved substantial costs as it reduced imports and raised domestic prices for consumers. According to certain estimates, 27/ United States imports from Japan would have been superior by one half of their actual levels without VERs in 1985; and domestic prices would have been at least 15 per cent below their actual level had there been no VERs. In the European countries applying VERs, ceilings or quotas, it is likely that Japanese producers would have gained at least similar market shares as those prevailing already in the United Kingdom; but price effects were presumably more limited, owing to stronger competition among Community industries. According to the conclusions of the OECD study, protection provided firms with a breathing space and funds with which they were able to modernize; but that rationalization could have proceeded faster and more efficiently without protection.

73. The combined effects of protectionist policies and the expansionist reaction strategies of Japanese corporations also threaten to create large overcapacities on the world markets. In view of the virtual saturation of the United States market, slow growth of about 2 per cent per annum expected for EEC and Japan, and slow growth of demand in developing countries, the newly emerging production capacities may put great pressure on existing production and provoke further intensive adjustment needs.

74. While traditional import protection in the form of tariffs and quotas has not deterred developing countries from achieving a certain export success in major developed countries, anti-dumping action and other forms of protectionist pressures have affected the competitive position and expansion of developing countries' exports. Certain other forms of governmental adjustment measures in developed countries, in particular government aids for restructuring and investment subsidies for particular enterprises, delayed adjustments and relocation of new production and investment to more cost-effective sites,

including to developing countries. Finally, the overcapacity created on the North American car market at least partly as a reaction to protectionism threatens to put substantial pressure on the competitive position of those exporters from developing countries which are just at their start or remain generally weak in terms of financial and market power, product diversity, distribution and after-sales organization.

B. Structural change in developing countries

1. Government policies

75. The automobile industry has been a focus of government policies in many developing countries, as it was expected to act as a dynamic motor for the economy as a whole and provide substantial spread effect through backward and forward linkages with other industries and services.

76. Developing countries' policies varied from comprehensive sectoral policies regarding investment, production and foreign trade to relatively liberal investment and production policies admitting a large number of different assemblers. Most major-developing country producers and exporters applied, however, comprehensive sectoral policies throughout several decades. Such programmes of the Republic of Korea, Mexico, Brazil and others aimed at developing a rational and vertically integrated automotive industry. They limited frequently, at least for some years, the number of producers and models and regulated severely the access of new investors to the industry, in order to achieve efficient production runs and to enable national production of parts and components. Several countries imposed progressive and high targets for vertical integration of production or sub-contracting to domestic producers. Automotive industries also frequently enjoyed financial advantages, preferential credits and State aids and various fiscal concessions for their investment and/or rationalization programmes. In some cases, governments also adopted additional measures to stimulate the development of a national component industry beyond national contents rules and industrial rationalization, such as special financial programmes or regulations limiting component production by foreign TNCs.

77. The car industry has for a long period been oriented mainly towards import substitution, and has enjoyed substantial quantitative, tariff, and access protection against new investors, including exacting local content rules in favour of local components production. Until recently, several developing countries applied prohibitions on car imports. Oligopolistic market structures, dominance by foreign TNCs in vehicle production, and access restrictions were further characteristics in many developing countries. Several developing countries have, however, in recent years reduced substantially the protection granted to their domestic automotive producers. The Republic of Korea, Turkey, Yugoslavia and partially also major Latin American producers liberalized restrictions regarding access to the industry, removed exchange controls, reduced or removed import prohibitions and other forms of quantitative restrictions, and/or reduced certain import tariffs.

78. Since the mid-1980s, some developing countries adopted more vigorous export promotion strategies, in order to increase foreign-exchange earnings, and to raise efficiency of production to internationally competitive levels. The serious recession of many national and regional markets also contributed

to spur the car industry to explore alternative market opportunities abroad. Several countries undertook general macro-economic reforms, adopted more realistic exchange rate policies and strengthened their general export promotion machinery. Some countries also applied a range of sector-specific policies to encourage exports, co-operation with foreign companies and foreign investments into that industry.

79. Mexico and Brazil, for example, engaged in intensive negotiations with TNCs subsidiaries in their countries for improving the foreign-exchange balance of this sector. They used partly regulatory means, partly incentives to achieve this purpose: regulations requiring a certain degree of balance in trade between components imports and exports to third countries; fiscal export incentives ranging from tax exemptions for export production to more far-reaching tax credit schemes, etc.

80. The active governmental promotion of international co-operation with foreign enterprises played a substantial role in the development of the car industry. In recent years several governments made particular efforts to attract new investments by foreign enterprises to the industry if they were substantially export-oriented. The Republic of Korea, Yugoslavia, India, Malaysia and other countries attempted to develop a more independent national production and exports through a more diversified choice of forms of co-operation, in particular joint-venture arrangements, product and technology-licensing agreements, technical co-operation agreements and export marketing contracts. The Republic of Korea had initially attempted to develop an export-oriented car industry based on domestic companies and on complementary licensing and technical co-operation with foreign companies. As this policy failed to produce substantial exports, the Government promoted a closer involvement of foreign partners in the form of equity participation. Such an involvement of major foreign car producers was necessary to obtain their co-operation in the design of car models which could be marketed in the United States of America or Western Europe and which corresponded to the quality, technical security and environmental standards required. 28/ All major Korean automobile producers have now major Japanese or United States car producers as partners with minority (or equal) equity holdings. These partners provided also the basic car models and undertake for two of the three exporters the export marketing. The major Yugoslav automobile producer as well as the car assemblers developed their production and export on the basis of long-term co-operation agreements, regarding products, technology and marketing. 29/ More recently, there has, however, also been a tendency of shifting towards joint venture arrangements with foreign partners in complement to the long-term agreements.

81. The trend towards increased international co-operation also spread rapidly to the components industry. In this subsector, the number of joint ventures and production and technology licensing has increased very rapidly, for example, in the Republic of Korea and Yugoslavia, and various South-East Asian countries. 30/ The Republic of Korea also developed a specific programme for support to the components industry which provides financial and technical aid to limit import dependence. A wide range of supplementary measures is foreseen within a general plan for Koreanization of industry as a whole (including the establishment of a Korean Development Fund, a Fund to support Technological Development and an Export Promotion Fund). The Government further encouraged car producers to invest at least 1 per cent

of sales into research and development. The Government further supports co-operation and standardization among the three big car producers, so that they can develop and use the same components in their respective production for domestic and export markets.

82. Some developing countries also took special measures to encourage exports of parts and components by foreign TNCs. In the framework of long-term contracts with Yugoslav partners, foreign companies are entitled to import foreign cars to the extent of their exports of Yugoslav components or sub-assemblies. In a similar manner, certain TNC producers in Latin American countries had been entitled within their contractual arrangements to increase imports of components, to the extent that they exported motors produced locally by them, or other parts or components produced by independent domestic producers. Nevertheless, Original-Equipment-Manufacturing (OEM) exports produced by TNC subsidiaries or affiliated joint ventures constitute a major portion of overall engine or components exports from developing countries.

83. To some extent the industrial policies, in particular where they were at the same time aiming at export development, have been quite successful, as recent records have shown. However, excessive domestic regulations and import restrictions have either not been implementable or had also important disadvantages: excessive national contents requirements could not be achieved in many cases; in others they led to substantial cost increases and reduced competitiveness. Apart from the cases where production of components is directly organized by foreign car producers, component production has remained weak in many developing countries. This is particularly the case in those countries, where car assembly is scattered over a wide range of car types and models. But this is also the case to some extent in developing countries with major car production and exports. There are a number of cases, where export models contain a far lower percentage of domestic components than the models sold for the domestic market, for reasons of price, quality and technical standards. The recent spread of industrial deregulation and import liberalization should provide a spur to domestic demand in many developing countries: it may also enhance export competitiveness, provided that energetic steps are simultaneously taken by governments, domestic car producers and eventually foreign partners to rationalize and upgrade domestic components production.

2. Factors motivating changes

84. Several factors combined to enable the rise of developing countries' car exports during the 1980s: the increased emphasis on international co-operation and export development by developing countries concerned; the new corporate policies of major TNCs aiming at global specialization; as well as important cost advantages of developing country production. The regained dynamics of the world automobile market since the mid-1980s facilitated substantially this export expansion. Developing-country producers, whose strategy was based on exports of smaller, price-competitive, car models to the United States market were able to enter a market niche, where competition from Japanese exporters became less intensive: United States import restrictions and the revaluation of the yen had induced them to shift their exports progressively to larger and higher quality cars.

85. The new emphasis on export-oriented macro-economic policies by several developing countries implied inter alia substantial and repeated currency devaluation. As a result, exporting became more remunerative, while import-based assembly became more costly and met with reduced domestic demand.

86. The main producer countries have reached a market size which makes it possible to produce at internationally competitive scales and to apply modern production methods. Investment and production restrictions of the Governments of the Republic of Korea, Brazil, Mexico and Yugoslavia (see chapter IV.B) also ensured that the large size of the markets results effectively in large-scale production by individual companies. Some producers now reach a size of production comparable with that of important developed country companies: Hyundai's production (600,000 cars in 1988) is of the same range as that of Mitsubishi (Japan) and Ford (Federal Republic of Germany). Production of Autolatina, the biggest Latin American car producer (joint venture between VW and Ford of Brazil and Argentina producing about 500,000 cars in 1988), followed closely behind. Production of several other developing-country firms ranged between 110,000 and 240,000 (Chevrolet of Brazil; Zastava of Yugoslavia; Daewoo and Kia of Republic of Korea; Fiat of Brazil), which corresponds by and large to the size of smaller Japanese companies (Isuzu, Daihatsu, Suzuki).

87. Heavy investment by developing-country companies, as well as TNCs, in recent years has also led to the creation of modern new production capacities. In a few instances, new plants in developing countries have been established exactly according to Japanese models. Partial robotization and automatization have also made progress in the car industries of major developing producer countries. 31/ Part of the producers are therefore able to meet the technical specifications and quality for world market exports or OEM supplies of cars, motors and parts. TNCs played an important role in this process, either through their subsidiaries, or as joint venture partners.

88. The rapidly rising technological, financial and marketing capacity of certain developing country producers is also exemplified by the fact that some of them are getting engaged in foreign investment in major overseas markets. The major Korean car manufacturer, for example, has recently established its own assembly plant for a medium-size car model in Canada, together with a component plant to get a better footing in the North American market and to counter protectionist pressures and origin requirements.

89. Developing-country producers also enjoy major labour cost advantages vis-à-vis developed country competitors. This is particularly important for parts and components production where they may reach about one third of total production costs. In 1985, hourly wage cost (wages plus social cost) of the automobile industry amounted to about $20 in the United States, $12 in the Federal Republic of Germany, $6 in Japan, but only $1.7 in Brazil and the Republic of Korea. 32/ By 1988, the Federal Republic of Germany became the highest wage-cost country, just ahead of the United States of America and Japan ($22, $21 and $19 respectively). 33/ Costs of Latin American producers, and in particular Mexico, tended to become comparatively lower than in Asia, owing to repeated currency devaluations and the fact that Korean labour costs tended to rise due to sharp wage increases and a steady trend of currency appreciation (by about one quarter since 1986). But Korean labour costs in the automobile industry still amounted only to one sixth of United States and

one third of Spanish labour costs in 1988. 34/ Moreover, the Republic of Korea and Brazil possess efficient steel industries, as raw material suppliers (through high protection to input industries has in the past diminished this potential advantage in the latter country).

90. According to certain estimates, low-wage advantages were however not decisive in procuring a competitive advantage to the Brazilian car industry by 1985: in spite of much lower Brazilian wages, total labour cost for the production of an equivalent car model in Japan was about 40 per cent lower than in Brazil and about 60 per cent lower than in the Federal Republic of Germany. Total production cost for a comparable car in Brazil stood at about 40 per cent above the Japanese cost and relatively close to the German cost, which exceeded Japanese levels by one third. Substantial transfer payments from the State budget to the enterprises were necessary to compensate for these cost differentials and render Brazilian car exports internationally competitive. 35/

91. Developing countries' car and components industries face basically the same challenges as many developed countries' companies: they need to increase productivity continuously, to invest in new technologies, to modernize their production systems and to upgrade the level of qualification of their staff, if they want to achieve international competitiveness and acquire lasting export positions.

IV. PROSPECTS FOR DEVELOPING COUNTRIES

92. The rapid export success of a few developing countries should not divert attention from the fact that only Republic of Korea producers have been able to gain an independent foothold in the United States and Canadian markets, and even they eventually suffered setbacks. Rapid changes, which are characteristic for consumption, technology, and competitive positions, placed high demands on technical, managerial and financial capacities of car producers in developing countries. They have caused high rates of instability in the past and are likely to create substantial uncertainty in the future. Most of the export increases coincided with, and benefited from, the recent car boom in developed countries, which coincided with the installation of modern production capacities and the rationalization of existing plants. Low labour costs alone have not been the only argument for competitiveness and will even be less so in future, with the increasing automatization of production processes and the sharp decreases in the proportion of labour in total cost: recent experience has shown that management, production and labour organization have been more important factors for successful international competition. Product design and extensive adaptation to consumer demand have been essential for the success or failure of developing countries.

93. For smaller cars - the most dynamic developing country export product - market perspectives are uncertain: their long-term consumption growth is likely to be slower than the already very moderate average consumption growth expected in major markets. The longer-term danger of new over-capacities would also affect this market segment through stiffer international competition, as well as potential pressures for protectionism. But South-East Asian car producers can count on dynamic home markets as a firm base for export success and the strong dynamics of regional economies may also open some perspectives for export development in the longer term. Furthermore, there is still considerable scope for developing exports to Western European markets, which would also reduce the negative aspects of present overdependence on the United States market. They might thus pursue a policy of filling market niches for special types of cars with shorter production runs. This area may also provide some changes for other developing producers aiming at developing exports to world markets, such as India, Malaysia, Taiwan Province of China, Turkey and Thailand. But "niche strategies" are also subject to rapid switches in consumer behaviour and require outstanding capacity to anticipate and adjust to such changes.

94. Consumption and market trends appear to offer favourable prospects for vehicle parts and components production in developing countries. Consumption is also likely to grow faster than for cars: the trend towards safer and more comfortable cars, the spread of mandatory car controls, the needs of environment protection, as well as the introduction of a range of new equipment into standard models are factors, which will influence favourably the growth of component production. On the other hand, technical progress and the emphasis on stringent quality should lead to longer-lasting parts and slower replacement cycles. On balance, it is expected that for example the European market for parts and components will grow in volume terms at a rate of 3 per cent - 4 per cent per annum in the longer run. 36/

95. Developing-country producers also have opportunites to participate in this consumption growth. Many of them have already acquired experience and the confidence of international car producers, as export records tend to show. Labour cost advantages remain important in this branch. The tendency of major

car producers to reduce their own components production increases the scope for independent producers. Tighter competition among car producers is likely to promote the use of sub-contracting to low-cost developing countries: Japanese car producers are already involved in building up sub-contracting networks in low-cost South-East Asian countries.

96. Prospects are, however, not equal for all types of components and producers. OEM-sourcing of engines from Latin American countries may lose ground when the domestic engine production in the United States of America by Japanese producers comes on stream. The new organization of links between car manufacturers and their suppliers imposes increased requirements on component producers: closeness, if not physical, needs at least to be assured through rapid and reliable communication and transport links if developing-country producers are to be able to ensure just-in-time delivery, high quality standards and participation in technological development. Japanese car producers also show some tendency to bring important Japanese sub-contractors for part production along when investing abroad instead of relying on domestic producers. Others assist national component producers in upgrading production, organization and quality. Many of the Japanese parts firms, which are frequently smaller or medium-scale enterprises, prefer to enter into joint ventures with local producers, when following suit with foreign investment. They may provide with their operations an important demonstration effect for the domestic component industry, in terms of technology, production, organization and export marketing. The strengthening of the technical, financial and managerial capacity of component suppliers will be the most essential key to export success in the components industry.

97. The export dynamics of cars are also likely to stimulate subsequent replacement exports of parts and components, to the extent that they had been sourced originally from domestic producers in the exporting countries. Furthermore, foreign investment by developing countries' enterprises abroad will also stimulate parts and components trade.

98. Policies to strengthen developing countries' production and export capacities in car production will continue to rely in future on international co-operation with leading world market producers for licensing or developing a product which is marketable in major developed countries. Alternative choices for the form of co-operation should, however, increase. They will include full-scale reliance on TNC subsidiaries, joint ventures between domestic firms and TNCs, but also various forms of trilateral co-operation separating product conception from the functions of production and export marketing through co-operation with different TNC partners. This choice is largely determined by the technological, financial and marketing capacity of domestic firms as well as the attractiveness and growth of the home market. The gradual building up of national design capacities for product adaptation, substantial rise in expenditure in research and development, and the building up of an independent export marketing capacity would seem essential factors for a lasting and sustained export success for passenger cars on major world markets.

99. Policies and measures to exploit the potential for expansion of component production and exports should aim at strengthening the capacity of domestic component suppliers to serve car producers in major markets, which are geographically close. Both developed-country governments and car producers have played and can play a major role in upgrading the management, organization, technical capacities and quality control in components industries within the framework of joint ventures or sub-contracting arrangements.

100. Specific promotional measures could include the following:

(a) Developing countries could further increase flexibility in their regulations pertaining to the establishment of export-oriented joint ventures in automotive industries and to a careful promotion of technology transfer and international sub-contracting.

(b) Host countries can effectively support the development of export supply capacities through financial support and tax relief for investment in modernization, computerization, quality control, as well as for research and technology programmes. In addition to grants and concessional loans, accelerated tax write-offs and similar incentives, support measures to domestic enterprises and joint ventures could extend to increasing involvement of universities in enterprise-oriented research, as well as to the organization of special vocational training programmes tailored to the specific needs of individual enterprises.

(c) As has been done in several cases, by Japanese and other countries' enterprises, TNCs can provide support through management advice, assistance in upgrading of production organization and quality, the conduct of training programmes and the like within joint ventures and related contractual arrangements.

(d) Host countries need to provide improved infrastructural facilities required by component producers to accelerate communications and transport (for example, industrial parks with modern telecommunications facilities, access to international computer and information networks, rapid access to airports and ports, etc.).

(e) Developed countries and regional groupings such as EEC should encourage technological co-operation with car and component producers in developing countries and facilitate participation by firms of such countries in their research and technology programmes and projects (in particular within the framework of existing bilateral associations or trade co-operation agreements with developing countries).

(f) Developed countries should encourage their industries to increase the sourcing of components in developing countries or establish joint ventures (through appropriate investment guarantees and incentives and export credits, in particular for small- and medium-scale enterprises interested in investing into joint ventures or entering into sub-contracting arrangements in developing countries; and through attractive passive processing regulations, etc.).

(g) Developed countries should in particular maintain and improve liberal market access for developing countries, in parallel with progress in their own market integration. This is an indispensable counterpart to industrial deregulation and import liberalization in developing countries. These policies can only be pursued consequently if markets are open for their exports to balance the domestic and foreign-exchange effects for the developing countries.

Notes

1/ For the purpose of this study, vehicle parts concentrate on products of the automobile industry of special export importance for developing countries, i.e. SITC headings 711.5 and 732.8 (Rev.1).

2/ B. Jetin, "Modernisation et compétitivité dans l'industrie automobile: le cas brésilien" in Problèmes d'Amérique Latine, N.D. No. 4874, Paris 1988.

3/ J.R. Rocha, "Las exportaciones: respuesta a la crisis de la industria automovilística", in Comercio Exterior, Mexico, November 1988.

4/ J.Ph. Rennard, "La Corée du Sud, nouveau grand de l'industrie automobile mondiale" in Industrie et Développement International, Paris, February 1989; and Automobile Industry in Korea 1988, by the Korean Auto Industries Co-operative Association (KAICA), Seoul, Republic of Korea.

5/ Cedomir Nestorovic, "L'industrie automobile yougoslave", in Courrier des Pays de l'Est, No. 345, December 1989.

6/ L'ARGUS, Special Issue, September-October 1989; and World Motor Vehicle Data, 1989, Motor Vehicle Manufacturers' Association of the United States.

7/ Tatsachen und Zahlen aus der Kraftverkehrswirtschaft, 53. Folge 1989, Verband der Automobilindustrie e.V., Frankfurt am Main, 1989.

8/ Digest of Japanese Industry and Technology, Automobile Industry Special, No. 250, 1989 and VdA, op. cit.

9/ World Motor Vehicle Data, Motor Vehicle Manufacturers' Association, United States of America, 1989.

10/ J.Ph. Rennard, op. cit.

11/ Korean Automobile Manufacturers' Association, Annual Report 1988.

12/ A. Altshuler et al., The Future of the Automobile, 1984.

13/ Panorama of EC Industry, 1989, by EEC Commission, Brussels.

14/ For further elaboration of the adjustment pressures and processes at work in developed countries, see D.T. Jones, "Structural Adjustment in the Automobile Industry", STI Review No. 3, April 1988.

15/ Panorama of EC Industry, 1989, op. cit.

16/ Panorama of EC Industry, 1989, op. cit.

17/ "Review of developments in the trading system", September 1988 - February 1989, GATT document L/6530, Appendix V, Geneva 1989.

18/ Imports under Items 806.30 and 807.00 of the Tariff Schedules of the United States, 1984-1987, USITC Publication No. 2144, Washington.

19/ D.T. Jones, op. cit.

20/ Industrie et Développement dans le Monde, Rapport 1988/89, Section on automobile industry.

21/ D.T. Jones, op. cit.

22/ UN-CTC data base on outward foreign investment.

23/ Current management situation of Japanese manufacturing enterprises in Europe (The fourth current situation survey report), by JETRO, International Economic and Trade Information Center, Tokyo, March 1988.

24/ J.Ph. Rennard, op. cit.

25/ Panorama of EC Industry, op. cit.

26/ Panorama of EC Industry, op. cit.

27/ The Cost of Restricting Imports: The Automobile Industry, OECD, Paris, 1987.

28/ See J.Ph. Rennard, op. cit.

29/ See C. Nestorovic, op. cit.

30/ See Annual Report of the Korean Automobile Manufacturers' Association, 1988

31/ See UNIDO, Industrie et Développement dans le Monde, op. cit.

32/ B. Jetin, op. cit.

33/ "Auto 88/89", Jahresbericht des VDA.

34/ Motor vehicle facts and figures 1989, MVMA, United States of America, 1989.

35/ B. Jetin, op. cit.

36/ Panorama of EC-Industry, op. cit.

TABLE 1

INTERNATIONAL TRADE IN PASSENGER ROAD VEHICLES a/ 1980-1988

	Exports in current values (billion $US)					Index 1988 (1980 = 100)	Shares in world exports (in %)	
	1980	1985	1986	1987	1988		1980	1988
Total World exports	66.8	88.1	114.0	133.2	146.8	220	100	100
Exports from developed countries to:								
- World	63.5	84.8	109.3	125.4	137.2	216	95	93
- Developed countries	54.8	77.5	102.8	117.5	126.8	231	82	86
- Developing countries	8.8	6.5	6.2	7.6	9.9	115	13	7
Exports from developing countries to:								
- World	1.3	2.1	3.2	6.1	6.9	526	2.0	4.7
- Developed countries (total)	0.3	1.2	2.4	5.1	5.4	1695	0.5	3.7
United States	0.1	0.4	1.8	4.0	4.3	...	0.1	2.9
EEC	0.2	0.3	0.2	0.6	0.7	336	0.3	0.5
- Developing countries	1.0	0.8	0.8	0.9	1.3	127	1.5	0.9
Share of developing countries in total exports to developed countries in %	0.6	1.5	2.2	4.1	4.1			

Source: UNSO, Comtrade data base.

a/ SITC Rev. 2, 781.0, 784.1, 785.1, 785.2 and 785.31 (excluding parts and accessories of 784.9, engines of 713.2 and electrical equipment for cars and engines of 778.3.

TABLE 2

MAIN EXPORTERS OF MOTOR VEHICLES (in billion $US, 1980 = 100)

Main exporting countries	Road motor vehicles (SITC 732) a/				Passenger motor cars (SITC 732.1) b/				Lorries and trucks (SITC 732.3) c/			
	1980	1987	1988	Index 1987 1980=100	1980	1987	1988	Index 1987 1980=100	1980	1987	1988	Index 1987 1980=100
A. Developed countries (total):	118.2	215.6	...	182	...	...	...	208	...	...	...	137
United States	14.3	21.4	25.1	150	4.0	7.3	8.8	180	1.6	2.5	2.6	158
Canada	9.1	23.3	...	255	4.0	10.8	...	271	2.1	4.6	...	216
Japan	28.1	57.5	59.9	205	16.1	35.7	38.7	221	6.2	8.4	8.8	136
EEC d/												
- France	12.3	16.3	17.5	133	6.8	8.5	9.8	126	1.4	1.1	1.3	76
- Germany, Fed. Rep. of	26.3	50.5	53.3	192	14.6	33.2	33.3	228	3.3	3.7	4.1	113
- Italy	5.7	8.2	9.2	144	2.4	3.7	4.0	152	0.7	1.1	1.2	148
- Spain	2.2	5.4	6.9	248	1.5	3.7	4.3	244	0.2	0.4	0.8	63
- United Kingdom	7.0	7.8	...	112	1.9	3.3	...	167	1.0	0.7	...	219
Sweden	3.5	6.7	7.1	192	1.2	3.1	3.0	262	1.2	1.7	1.8	147
B. Developing countries and territories:												
Republic of Korea	0.1	3.0	...	...	0.1	2.7	...	...	...	...	...	100
Brazil: Total	1.0	2.1	...	200	0.3	1.0	...	295	0.4	0.6	...	158
DMEC	0.2	1.3	...	545	0.05	0.7	0.0	...	0.1	0.2	...	...
Mexico: Total	0.3	1.5	...	452	0.1	1.1	...	...	0.0	...	0.0	...
DMEC	0.3	1.4	...	525	0.1	1.0	...	...	0.0	...	0.0	...
Yugoslavia	0.4	0.7	0.6	155	0.1	0.3	0.3	266	0.0	...	0.0	...
Taiwan: DMEC e/	0.0	0.3	...	1423	0.0	0.1	...	...	0.0	...	0.0	...

Source: UNSO, Comtrade data base.

a/ SITC Rev 1, 732: includes passenger motor cars, buses, lorries and trucks, special purpose vehicles, bodies, chassis and other parts of motor vehicles, as well as motor cycles.

b/ SITC 732.1: passenger motor cars (other than buses).

c/ SITC 732.3 does not include special purpose lorries, trucks or vans.

d/ Data include exports to EEC.

e/ Import data reported by DMECs.

TABLE 3

MAIN EXPORTERS OF PARTS AND COMPONENTS OF ROAD MOTOR VEHICLES (in million $US 1980 = 100)

Main exporting countries	Bodies, chassis and other parts (SITC 732.8) a/				Engines (SITC 711.5) b/			
	1980	1987	1988	Index 1987 (1980=100)	1980	1987	1988	Index 1987 (1980=100)
A. Developed countries (total):	30 400	59 200	...	195	...	...	...	150
United States	7 100	10 400	12 384	146	3 400	3 900	4 721	114
Canada	2 700	7 500	...	275	500	1 600	...	335
Japan	2 000	10 700	9 131	532	1 800	4 800	5 819	270
EEC c/								
- France	3 700	6 300	5 900	170	1 240	1 600	2 424	131
- Germany, Fed Rep of	6 400	11 700	13 631	183	2 900	4 200	5 141	148
- Italy	1 900	2 800	3 288	149	700	900	967	131
- Spain	400	1 200	1 559	299	400	400	527	207
- United Kingdom	3 400	3 700	...	109	1 800	1 200	...	69
Sweden	900	1 600	1 854	174	400	700	782	159
B. Developing countries and territories:	...	...	...	275	...	...	...	360
Republic of Korea	20	160	...	800	14	64	...	457
Brazil: Total	220	495	...	225	349	610	...	175
DMEC	90	329	...	364	279	536	...	192
Mexico: Total	202	366	...	181	57	1 370	...	...
DMEC	178	357	...	201	47	1 359	...	...
Yugoslavia	220	286	285	130	81	100	111	123
Singapore	82	98	138	120	99	123	164	124
India	49	39 f/	...	80	64	44 f/	...	69
Argentina	49	67	85	137	0	21	35	...
Turkey	6	71	60	1 180	5	39	...	780
Taiwan: DMEC d/	18	278	...	1 540	14	51	...	364
Philippines	30	30 e/	14	100	0	0	...	...
Thailand	9	21	...	230	1	6	...	...
Venezuela	7	16	36	212	0	0	...	...
Morocco	7	15	21	229	...	1	4	...
Tunisia	...	19	22	...	...	5	6	...

Source: UNSO, Comtrade data base.

a/ SITC Rev 1: Parts for motor vehicles excluding motorcycles; (excludes rubber-tyres, engines, chassis with engines mounted, electrical parts).

b/ Internal combustion engines, other than for aircraft.

c/ Including EEC intra-trade.

d/ Import data reported by DMEC countries.

e/ 1986.

f/ 1985.

TABLE 4

IMPORT STRUCTURE OF MAJOR DMEC's FOR PASSENGER MOTOR CARS AND VEHICLE PARTS

	Imports 1987 in mill. $US	Index 1987 (1980 = 100)	Main partner countries:				Developing countries	Republic of Korea	Taiwan Province of China	Brazil	Mexico	Yugoslavia
			EEC	US/Can.	EFTA	Japan						
A. Passenger motor cars (SITC 732.1)												
Main importers:												
United States	49 925	277	22	21	4	46	7.5	4.4	...	0.5	2.4	0.3
Canada	9 457	247	6	70	1	20	3.3	2.0 e/	0.5	...	0.5	...
Japan	2 031	449	92	5	2	..	0.5	0.3 b/	...	...	...	...
EEC												
- Federal Republic of Germany	9 857	204	63	1	3	33	0.7	0.2	...	...	...	0.5
- United Kingdom	8 521	169	79	0	4	15	0.6	0.3	...	...	...	0.3
- France	7 521	232	86	2	1	6	1.3	...	...	...	...	1.2
- Italy	7 378	160	92	0	2	1	4.6	0.1	...	3.7	...	0.7
B. Bodies, chassis and parts (SITC 732.8)												
Main importers:												
United States	13 086	333	18	39	1	31	10.2 c/	0.7	1.6	2.5	4.9	...
Canada	10 450	198	2	92	1	2	2.7	0.1	0.2	2.2	2.2	...
Japan	340	336	47	27	3	..	12.3	4.9	4.3	...	...	...
EEC												
- Federal Republic of Germany	4 072	199	74	3	13	6	3.3	...	...	0.5	0.9	1.6
- United Kingdom	4 220	287	83	4	4	8	0.9 d/	0.2 c/	...	0.3	...	...
- France	2 996	159	87	3	3	2	2.1	...	...	...	...	2.1
- Italy	1 618	166	89	1	6	0	2.5	...	...	0.6	...	1.4
C. Internal combustion engines (not for aircraft) (SITC 711.5)												
Main importers:												
United States	6 513	316	21	25	1	31	22.6	0.2	0.5	6.7	14.9	...
Canada	2 739	156	3	79	1	10	6.9	...	...	...	6.2	...
Japan	177	144	34	46	5	..	5.6	4.1 b/	...	0.2	1.0	...
EEC												
- Federal Republic of Germany	2 099	256	47	4	33 a/	3	8.0	0.7	...	1.3	4.4	1.1
- United Kingdom	1 454	236	57	9	10	17	2.2	0.6 b/	...	0.7	0.4	...
- France	1 200	198	77	6	3	6	3.7	...	...	...	2.6	0.6
- Italy	832	112	75	5	8	1	10.6	1.3	...	8.4	...	...

Source: UNSO, Comtrade data base.

a/ Mainly Austria.

b/ Total South and South East Asia, incl. Malaysia, Philippines, etc.

c/ Other small DC suppliers: Singapore (13), Argentina (10), Colombia (16), Venezuela (15).

d/ Incl. Turkey (7).

TABLE 5

PRODUCTION INDICES AND EMPLOYMENT OF THE AUTOMOTIVE INDUSTRY (ISIC 3843)

	Production index (ISIC 3843) (1980 = 100)						Employment (in thousands)					
	1978	1980	1985	1986	1987	Growth rates 1977-86	1978	1980	1985	1986	1987	1988
Developed countries												
United States	134	100	147	147	...	+1.9	1 061	820	871	845	...	...
Canada	138	100	158 d/	...	...	+2.0 g/	123	106	124	133	...	...
Japan	...	...	...	...	...	+2.8 a/	627	672	765	753	...	...
European Community f/	...	...	...	...	...	...	...	2 207	1 989	...	...	...
- France	...	...	...	...	...	-0.9 a/	...	...	...	369 b/	...	...
- German, Federal Republic of	96	100	123	130	...	+3.8	...	...	717 b/	748 b/	762 b/	767 b/
- Italy	94	100	91	98	...	+1.3	...	266 c/	210	201 b/	...	...
- Spain	98	100	119	132	...	+3.5	116	159	143 d/	137 b/	...	...
- United Kingdom	108	100	91	89	...	-2.4	486	302	277	253 b/	...	...
Developing countries												
Republic of Korea	...	100	265	295	...	+16.6	56	51 e/	79	...	...	...
Brazil	...	...	...	...	...	...	...	...	...	...	...	...
Mexico	...	...	...	...	...	...	39	52	45	43	...	...
Yugoslavia	...	100	170	176	...	+3.7	...	...	...	...	...	...

Source: UNIDO, Industrial Statistics.

a/ Transport equipment, ISIC 384.

b/ Source: VdA, GFR.

c/ 1983.

d/ 1984.

e/ 1982.

f/ Panorama of EEC Industry, 1989.

g/ 1977-1984.

TABLE 6

PRODUCTION OF PASSENGER CARS (in million units) a/

	1978	1980	1985	1986	1987	1988	Index 1988-1978
A. Major developed countries:	28.9	25.9	28.8	29.0	29.1	30.2	104
United States of America	9.2	6.4	8.0	7.5	7.1	7.1	77
Canada	1.1	0.8	1.1	1.1	0.8	1.0	90 c/
Japan	6.0	7.0	7.6	7.8	7.9	8.2	137
EEC	12.3	11.4	11.7	12.2	12.9	13.4	109
- France	3.6	3.5	2.8	2.7	3.0	3.1	87
- Germany, Fed. Rep.	3.9	3.5	4.2	4.3	4.3	4.3	110
- Italy	1.5	1.4	1.4	1.6	1.7	1.9	125
- Spain	1.0	1.0	1.2	1.3	1.4	1.6	157
- United Kingdom	1.2	0.9	1.0	1.0	1.1	1.2	100
B. Major developing countries:							
Rep. of Korea	0.09	0.06	0.26	0.46	0.78	0.87	940
Brazil (incl. delivery vans) b/	0.56	0.65	0.46	0.48	0.40	0.40	70
Mexico (incl. delivery vans) b/	0.25	0.32	0.29	0.20	0.82 0.23	0.68 ...	0.78 (110) c/
Argentina	0.14	0.22	0.12	0.15	0.21 0.16	0.35 ...	0.28 (100) c/
Yugoslavia	0.19	0.19	0.23	0.21	0.31	0.31	163
Turkey	0.05	0.05	0.06	0.08	0.11	0.10	200
India	0.05	0.05	0.12	0.13	0.16	0.17	380
Total of countries listed	1.33	1.53	1.53	1.70	1.87	2.28	170 c/

Source: UNSO, Monthly Statistical Bulletin.

a/ Excludes commercial vehicles.

b/ As grouped by car producers' associations. Source: Vd.A, GFR.

c/ Estimate.

TABLE 7

REGISTRATION OF NEW PASSENGER CARS IN MAJOR MARKETS
(in million units)

Countries	1978	1982	1987	1988	Increase 1978-1988	Number of passenger cars per 1,000 inhabitants a/
United States of America	10.9	7.8	10.1	10.1	92	570
Canada	1.0	0.7	1.1	1.1	106	463
Japan	2.7	3.0	3.4	3.8	140	251
EEC	9.5	9.3	11.2	11.8 b/	124 b/	...
- France	1.9	2.1	2.1	2.2	114	403
- Germany, Fed. Rep.	2.7	2.2	2.9	2.8	105	475
- Italy	1.1	1.9	1.9	2.1 b/	140 b/	409
- Spain	0.7	0.5	0.9	1.1	165	263
- United Kingdom	1.7	1.6	2.1	2.3 b/	137 b/	362

Source: UNSO and VdA (FRG).

a/ Most recent year for which data are available.

b/ Estimates based on partial data.

TABLE 8

INVESTMENT/SALES RATIOS OF MAJOR CAR PRODUCING COUNTRIES a/

	USA	Japan	UK	GFR	Italy	Spain	Mexico	Rep.of Korea
1980	5.4	4.7	6.4	--	--	--	2.2	--
1981	7.1	5.2	4.7	--	--	--	2.3	--
1982	2.6	5.3	4.4	7.3	--	3.2	1.4	3.2
1983	1.6	4.2	4.1	6.6	12.2	2.5	1.5	4.1
1984	2.4	3.8	4.7	5.5	6.9	6.8	0.9	5.0
1985	3.4	5.3	4.6	5.8	4.3	--	--	8.1
1986	3.8	5.0	--	--	--	--	--	--

Source: UNIDO Industrial Statistics Yearbook 1986 and earlier issues.

a/ Gross fixed capital formation
Output (in producers prices)

TABLE 9

SELECTED STATE AIDS TO THE MOTOR INDUSTRY a/

Country	Period	Company	Aid b/ (million)	
			Reported currency	Dollar equivalent
France				
3 litres research project	1981-85	Peugeot-Renault	FF 500	55
FIM modernization loans	1984-85	Peugeot-	FF 1.200	86
	1984-85	Renault	FF 1.250	102
Capital injections	1975-80	Renault	FF 1.520	169
	1982-85	Renault	FF 7.200	800
	1986	Renault	FF 5.000	557
	1987	Renault	FF 2.000	328
Debt cancellation (restructuration and transformation)	1987	Renault	FF 12.000	2.000
Low interest loans (innovations and modernization)	1985-87	Peugeot	FF 1.700	260
Germany (Federal Rep.)				
Auto 2000 research project	1980-84	VW/D-Benz/ Berlin Univ.	DM 148	50
United Kingdom				
Capital injection	1978-83	BL	£ 2.009	2.612
Regional and other grants	1976-83	Ford	£ 158	205
	1979-82	Peugeot	£ 59	77
	1979-83	GM Vauxhall	£ 25	33
	1988-91 (projection)	Nissan	£ 112	146
Capital injection (restructuration)	1986	Rover	£ 469	690
Netherlands				
Grants	1977-83	Volvo	Gld 550	170
	1984-86	Volvo	Gld 460	142

TABLE 9 (continued)

Country	Period	Company	Aid b/ (million) Reported currency	Dollar equivalent
Belgium				
Grants	1982-83	Ford	DM 51	17
Austria				
Grants	1980-81	GM	Sch 9.000	44
Investment grant	1989	Chrysler	. . .	
Spain				
Capital injection	1980-84	Seat	Ptas 123.000	718
Debt writeoffs	1985	Seat	Ptas 185.000	1.082
Grants	1985-89 VW (projected)	Seat	Ptas 46.000	269
Grants	1977	Ford	$ 100	100
	1982	Gm	$ 150	150
	1985	PSA	Ptas 40.000	234
	1986	Renault (projected)	Ptas 40.000	234
Capital injections	1986-91	ENASA	Ptas 5.000	45
(restructuring)	1987-91	ENASA	Ptas 96.000	870
Portugal				
Investment subsidy (regional aid)	1989	Ford (Audio-electron.)	ESC 17 billion (59% investment cost)	110
Italy				
Research grants and loan	1980-85	Fiat	L 480.000	251
	1982-87	Alfa Romeo	L 411.000	215
State layoff pay	1978-83 (continuing)	Fiat	L 200.000	52
	1978-83	Alfa Romeo	L 100.000	105
Modernization grants	1981-83	Fiat	L 137.000	72
Modernization	1982-87	Alfa Romeo	L 710.000	372

TABLE 9 (continued)

Country	Period	Company	Aid b/ (million)	
			Reported currency	Dollar equivalent
Italy (continued)				
Capital injection	1980-82	Alfa Romeo	L 510.000	267
Low interest loan (rationalization)	1986	Pai-Demm (components)	L 2.300	2
Interest subsidies (rationalization)	1986	"	L 7.700	6
Capital injection (loss compensation)	1985	Alfa Romeo	L 408.900	240
Subsidized R & D loan (innovation aid)	1989	Ferrari	L 41.600	33
United States				
Loan guarantees	1981	Chrysler	$ 1.500	1.500
Investment loan and grants (+ tax credit)	1989/90	Chrysler	$ 263 $ 103	263 103
Canada				
Repayable contribution	1985-86	AMC	$ 120	88

Source: K. Bhaskar, State aid to the European Motor Industry, East Anglia University, 1984.

a/ This table is included for illustrative purposes only and is not a comprehensive summary of state aid to the motor industry.

b/ Dollar equivalent calculated at current exchange rates.

In D.T. Jones, Structural Adjustment in the Automobile Industry, STI Review No.3, April 1988, OECD updated by UNCTAD Secretariat on the basis of Annual Reports on Competition Policy of the Commission of the European Communities and press sources.

---

(417)

Distr.
GENERAL

UNCTAD/ITP/47
7 November 1990

ENGLISH ONLY

UNITED NATIONS CONFERENCE ON TRADE AND DEVELOPMENT

STRUCTURAL CHANGES IN THE ELECTRONICS INDUSTRY DURING THE 1980s WITH PARTICULAR REFERENCE TO DEVELOPING COUNTRIES

Study prepared by the UNCTAD secretariat

The designations employed and the presentation of the material in this document do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations concerning the legal status of any country, territory, city or area, or of its authorities, or concerning the delimitation if its frontiers or boundaries.

GE.90-56015

CONTENTS

	Paragraphs	Page
Executive Summary	1 - 12	1
I. Introduction	13 - 17	3
II. Trade	18 - 30	4
A. Major trends	18 - 25	4
B. Structural changes	26 - 30	5
III. Production	31 - 57	8
A. Major trends and actors	31 - 34	8
B. Factors underlying structural change	35 - 40	9
C. Adjustment policies	41 - 57	10
1. Technology-related adjustment	43 - 44	10
2. Production strategy adjustment	45 - 51	11
3. Adjustments in employment	52 - 57	12
IV. Government and structural adjustment	58 - 92	14
A. Trade policies	59 - 73	14
1. European Economic Community	61 - 64	14
2. Japan	65 - 68	15
3. United States of America	69 - 71	15
4. Developing countries	72 - 73	15
B. National industrial policies	74 - 92	16
1. European Economic Community	76 - 80	16
2. Japan	81 - 82	17
3. United States of America	83 - 85	17
4. Developing countries	86 - 92	18
V. Policy options for developing countries	93 - 95	21
Statistical ANNEX		23

Foreword

In November 1989, the UNCTAD Committee on Manufactures decided, in paragraph 7 (a) of its resolution 14 (XII), to consider in its future work:

"Trends and features in the demand for, and supply of, manufactures and semi-manufactures, including changing patterns of comparative advantage, market access and export supply aspects in specific sectors of current and potential export interest to developing countries, taking into account work being carried out elsewhere in UNCTAD and the United Nations system".

This study forms part of the secretariat work programme in response to the Committee's request to the Secretary General of UNCTAD "to prepare documentation as appropriate to enable the Committee to consider these issues at its next session".

EXECUTIVE SUMMARY

1. During the 1980s, the electronics sector has been extremely dynamic, experiencing an above average growth in trade, production and consumption. The sprectrum of electronics products expanded significantly. In the field of consumer electronics several new products have been launched such as the video cassette recorders (VCRs) or the compact disk players (CDPs), the design of existing products has been improved and their use facilitated, and new strategic products are to be launched, such as the high-definition television (HDTV) or the cellular telephone. The product cycle length of several electronics products has dropped to less than 11 months, calling for rapid development of new product designs and products.

2. The interlinkage of the electronics industry has remained very high, with firms often producing in several product areas. Generally companies producing consumer electronics were also engaged in the production of telecommunication equipment, electronic components and armaments. Moreover, the industry involves only very few countries.

3. During the 1980s, the value of world trade in electronics grew at an average of 12 per cent per annum to reach $ US 100 billion in 1987. Over the period the share of electronics rose from about 2.4 per cent to 3.9 per cent. The composition of world electronics trade has shifted towards highly sophisticated and technologically advanced products. The main exporting countries and territories are Japan (34 per cent), the United States (12 per cent), the Federal Republic of Germany (9 per cent), the Republic of Korea (7 per cent), Taiwan Province of China (6 per cent), and Singapore (5 per cent). The major importers are the United States (30 per cent), the Federal Republic of Germany (9 per cent), the United Kingdom (7 per cent), Hong Kong (5 per cent), France (5 per cent) and Singapore (5 per cent). Socialist countries remained absent in electronics trade both, on the export and import side.

4. The 1980s were marked by the emergence of Japan and the Asian newly industrialized countries (NICs) as major net exporters of electronics goods. The United States and most European countries are losing their comparative advantage, and have become major net importers. The import penetration of electronics has been rising in all the major consumption markets except Japan. It is notable that the import penetration of products from developing countries expanded much less than the import penetration of products from developed market economies and that it remained very low.

5. The gain of export shares by developing countries is primarily concentrated on electronics goods with a slow rate of technological innovation. The shifts of trade flows which have occurred during the 1980s have primarily been influenced by the ongoing restructuring of the electronics industry in developed countries and the ensuing relocation of production units into major markets and low-wage countries with relatively high political and social stability and not unionized labour force. Developing countries have mainly benefited from the introduction of spatial fragmentation of production, the relocation of sunset electronics products manufacturing and low wages when attracting firms of developed countries.

6. Electronics production has been expanding, particularly in technologically advancing products. The shortening product cycles and volatile consumer preferences prevailing in the electronics market have led to intense competition among electronics companies. This has induced a worldwide restructuring wave in the electronics industry, particularly in developed countries. Technology has emerged as the foremost driving force of competition. It has led firms to increase their R & D effort, widen their scope for economies of scale and intensify co-operation even with competitors. This has generated a further concentration and internationalization of the electronics industry, inducing several mergers and take-overs in developed countries and the set-up of overseas production plants in developing countries. Firms have undertaken rationalization programmes to improve their productivity and internal organization in order to cut costs. In addition, electronics companies have notably increased their investments during the 1980s to increase their scale of operations. Firms' strategies have evolved towards a significant increase of inter-firm co-operation, particularly on the international level, in marketing, production, and research.

7. Employment has also been affected by these adjustments, particularly in Europe where the labour force of the electronics sector has been significantly reduced, to the advantage of several developing countries where jobs for unskilled labour have been created. However, this process has been at the expense of a much higher employment volatility in the latter countries. The skill level of the electronics sector has also been drastically upgraded in the developed countries and labour productivity significantly increased.

8. During the 1980s, governments have increasingly intervened to affect the ongoing adjustments in the electronics industry. In some countries they have speeded up the process while in others they have slowed it down. The major policy tools used for this purpose have been trade policy instruments and national industrial policy instruments.

9. The changed comparative advantage positions have given rise to increased use of trade measures to protect the national electronics industry. There has been an increased use of NTMs and trade-managing measures such as voluntary export restraints (VERs) and orderly marketing arrangements (OMAs) for fast-growing products such as VCRs or CD players. In addition, there has been a growing use of anti-dumping duties and tariff retaliation on these products. These measures have been applied essentially by the United States and EEC countries against Japan, Hong Kong, the Republic of Korea, Singapore and Taiwan Province of China.

10. The bulk of government efforts to influence the adjustment of their electronics industry has, however, gone through national industrial policies. These policies comprise competition laws, government fundings of industrial R & D, grants, loans, purchasing orders and protected supplier positions, and foreign investment codes. In the 1980s they essentially focused on R & D programmes in developed countries and foreign investment codes in developing countries.

11. In Europe, Japan and the United States several very important R & D programmes have been launched to assist or support private electronics firms to develop new products and gain competitiveness. In Europe, a major industrial policy development during the 1980s has been the initiation of supranational research programmes for the electronics sector, which also provided the framework for increased co-operation among private firms. The attitude of authorities in developed countries to the enforcement of prevailing competition laws has also changed towards more flexibility in allowing mergers and several co-operation forms among electronics enterprises.

12. In many developing countries there has been a tendency towards liberalizing the foreign investment codes. There has also been a strong effort to develop the incentives to attract foreign electronics companies through the expansion of free-trading zones or industrial and technology parcs. Finally most developing countries induce their local electronics firms to engage in joint ventures, original equipment manufacturing (OEMs), and other technology-sharing and marketing arrangements with foreign electronics enterprises.

I. INTRODUCTION

13. The 1980s have been witnessing an extraordinary expansion of electronic products, particularly for household use. Electronics production has grown twice as fast as total world output on average. The share of electronics broadly defined already represents about 6 per cent of the GDP of the OECD countries and is projected soon to reach more than 10 per cent. Trade in electronics products has been growing faster than world trade.[1] This has been possible because of the technological progress achieved in the area of miniaturization, but also because of drastic price cuts which made originally exclusive products accessible to mass consumption. That process has gone hand in hand with an adjustment of the production and trade structures.

14. Few studies analyse the consumer electronics ector owing to the lack of integrated data on the sector, particularly as far as production is concerned. This problem is aggravated by the extreme dynamism in product diversification and the fast emergence of new products which makes such data collection very difficult. It is thus necessary to focus on products for which production and trade data are available, hence limiting the consumer electronic sector to these products only. This implies that the most recent and probably most interesting products (such as high definition television (HDTV) etc.) are excluded from the quantitative analysis. That, however, is of relatively little consequence for the study of structural adjustment in the consumer electronics industry since it is not unreasonable to assume that the "new" electronics products will follow a pattern similar to the pattern observed for the "traditional" electronics products.

15. The spectrum of consumer electronic products is very large and is widening rapidly. It includes radio sets of all forms, from the portable battery radio to the high fidelity (hifi) receiver, passing through car radio and the combined radio-tape recorder sets, television sets of all sorts and sizes (with colour or black and white display) as well as the new HDTV, videos (VCRs), record players, tapedecks, compact disk (CD) players, walkmans, telephones, etc. In addition it includes calculators, micro-computers, electronic watches, etc. Almost all other products also contain some electronic components, either as an essential component or only as a gadget, and would thus qualify as an electronic product. It is beyond the scope of the present study to consider all of them.

16. At the product level, this study merely examines radios, colour and black-and-white televisions, record-players, sound recorders and reproducers, television image and sound recorders and reproducers, wire telephones and telegraphs, radiographic andradio -phonic receivers, television picture tubes and diodes, transistors and semiconductors (see annex table 1 for ISIC and SITC Rev. 1 and 2 codes), for the discussion of trade and production trends. However, given the very high degree of interlinkage of the electronics industry, a disaggregation down to the consumer electronics level does not always make sense, particularly when looking at organization and structure of the firms or at government intervention. Consequently, when discussing such issues, the study refers to the electronics industry in general.

17. The structure of the study is as follows: section II presents major features of, and changes in, trade in electronics products; section III discusses major trends in production based on UNIDO data and then turns to the forces driving structural adjustment and their effects on the structure of firms, employment and investment. section IV discusses how government action in the major countries has affected the adjustment process; section V summarizes the major conclusions.

1 See Hieronymi (1987), p. 36 and p. 40.

II. TRADE

A. Major trends

18. During the 1980s, the value of world trade in electronic products has more than doubled, growing from about $ US 44 billion in 1980 to $ US 100 billion in 1987, which corresponds to an average growth rate of 12 per cent per annum.[2] This growth path has been almost continuous and led to an increase of the share of electronics in total world trade of about 2.4 per cent to reach 3.9 per cent in 1987. This reflects the extreme dynamism of the electronics sector in the world economy. Trade in electronics products has essentially been featured by the emergence of Japan and some Asian NICs as major exporters, while the United States and European countries turned into net importers. It has also been characterized by the absence of socialist countries on the export and import side. The major exporting and importing countries are developed economies (EEC, EFTA, Japan and the United States).

19. In 1987, more than 70 per cent of world electronics imports originated from developed economies.[3] In that year Japan made up for more than 34 per cent of the world electronics exports, followed by the United States with 12 per cent and the Federal Republic of Germany with about 9 per cent. In the 1980s, average per annum growth rates of electronics exports for Japan, the Federal Republic of Germany and the United States have respectively been of 18.6 per cent, 9.5 per cent and 8.9 per cent. It is notable that all the major exporters in the EEC and Japan experienced a drop of their electronics exports over several years (from 1 to 3 years) before reaching levels above those prevailing prior to 1982. Despite this growth, all the major electronics exporters in developed countries experienced a drop in their share in world electronics exports over the period from 1980 to 1987 except Japan (gaining 4 per cent); the largest share losses being those of the United States with more than 3 per cent and the Federal Republic of Germany with about 2 per cent.

20. In 1987, developed economies accounted for 78 per cent of world imports, the EEC for 34 per cent (the Federal Republic of Germany about 9 per cent and the United Kingdom 7 per cent), the United States for 30 per cent and Japan for only 3 per cent. In the period from 1980 to 1987, most of the major developed importers of electronics increased their share in world electronics imports except the Federal Republic of Germany (its share shrank by about 2 per cent). This reflects an increasing import reliance for domestic consumption requirements by most developed economies. For the Federal Republic of Germany, however, the simultaneous drop of both import and export world shares seems to indicate an increase of the share of domestic production in relation to domestic consumption of electronics and thus a reduction of the reliance on trade. These figures are summarized in annex tables 2 and 3.

21. There have been very few net exporters of electronics over the 1980s. In developed economies, among the major exporters of electronics, only Japan has steadily remained an important net exporter. The United States, the United Kingdom and Italy have constantly been running important deficits. The position of the Federal Republic of Germany has been fluctuating as a net exporter occasionaly running deficits, as opposed to France which has been a net importer once running a surplus. The Netherlands started as a net exporter and turned into a net importer after 1982. Among the smaller countries Belgium and Sweden have consistently been net exporters.

---

2 Electronics are defined as 76+776 in SITC Rev. 2. The figures are based on imports if not indicated otherwise, the source being UNSO. Export figures would provide a downward biased estimate of total world trade flows of electronic products because many developing countries do not report after 1985 (e.g. Brazil or Mexico) and were consequently not used for world totals. Import and export figures for Brazil, Mexico and Taiwan Province of China are not available and have been estimated using the reported world exports to and imports from these countries respectively.

3 About 80 per cent of the reported world exports of electronics were from developed economies.

22. Several developing countries and territories have emerged as important exporters in recent years, most of which are NICs: Hong Kong, Republic of Korea, Malaysia, Mexico, Singapore and Taiwan Province of China. In fact, world electronics imports originating from South and South-East Asia and from developing America have steadily increased respectively from $ US 9.5 and 1.2 billion in 1980 to $ US 24.3 and $ US 2.8 billion in 1987. In 1987, exports from the South and South East Asian countries and territories provided for 25 per cent of the world imports of electronics (Republic of Korea 7.5 per cent, Taiwan Province of China 5.8 per cent, Singapore 5.3 per cent, Malaysia 3.7 per cent and Hong Kong 2.2 per cent) and the developing American countries for 2.8 per cent (Brazil 6 per cent and Mexico 2.2 per cent), while the share of African and West Asian countries has remained negligible. All the major exporters of electronics in developing countries and territories experienced large expansions of their exports during the 1980s, the Republic of Korea showing an average annual growth of its electronics exports of 51 per cent, Malaysia 30 per cent, Taiwan Province of China 20 per cent and Singapore 15 per cent . As a consequence, all the major developing exporters of electronics maintained or expanded their share in world exports during the period from 1980 to 1987. The most spectacular progress has been achieved by the Republic of Korea, gaining more than 4 per cent and Malaysia more than doubling its share to attain 3.7 per cent. The shares of Singapore and Taiwan Province of China both remained at the same level.

23. In 1987, developing countries accounted for about 20 per cent of world imports, the South and South- East Asian countries and territories alone accounting for 17 per cent (Hong Kong 5.1 per cent, Singapore 4.8 per cent, the Republic of Korea 3.7 per cent and Taiwan Province of China 3.3 per cent). Similarly to developed economies, major importers of electronics in developing countries were also major exporters of these products. Few, however, have been net exporters.

24. During the 1980s, the Republic of Korea and Taiwan Province of China have steadily increased their net exports. The Republic of Korea, expanding its net exports by, on average, 70 per cent per annum, has bypassed Taiwan Province of China to become the major net exporter of electronics amongst few developing countries. Malaysia started as a net importer and turned into an important net exporter after 1984. The net exporter positions of Mexico and Singapore have been fluctuating, both countries running a deficit once. Among other important developing countries involved in the electronics trade, Brazil, Indonesia and Hong Kong have been net importers throughout the 1980s.

25. International interpenetration has been progressing rapidly over the 1980s in this industry. Import penetration has been rising fast in major consumer markets except Japan. Most of this increase was due to market gains by other developed countries. While import penetration of products from developing countries grew continuously, their impact on developed country markets remained relatively limited: their market share amounted in 1987 to about 1 per cent in Japan and 7 per cent to 11 per cent in other major Western European and North American countries (see tables 2 and 3). The share of developing countries in developed-country imports of electronics grew only modestly, from 26 per cent to 29 per cent over this seven year period. An important portion of developing countries' exports consists of intra-firm trade, OEM and sub-contracting of parts and components.

B. Structural changes

26. Trade in electronics involves many products. During the period from 1980 to 1987, there was a shift in the composition of electronics trade away from technologically relatively stagnant products (e.g. radios, TV sets, microphones, loudspeakers and amplifiers, or TV tubes) towards goods showing rapid technological innovation (e.g. electronic microstructures, sound and picture recorders and reproducers, TV cameras and the like). In 1987, the most important electronics products, as measured by their share in total electronics trade, were: electronic microstructures with 19 per cent, parts of telecommunication and sound recording apparatus with 15 per cent, radio sets with 11 per cent, sound and picture recorders with 8 per cent, TV sets, wire telephones and

parts of electronic valves and tubes all with 7 per cent, and semiconductors with 5 per cent. All the remaining products each accounted for less than 5 per cent of electronics trade.[4]

27. During the 1980s, sound and picture recorders and reproducers and TV cameras have expanded very rapidly, at rates close to 50 per cent per annum. Wire telephones and radiotelephonic receivers also grew relatively fast, both with an average annual growth rate of 30 per cent as well as electronic microstructures with 25 per cent. This is essentially a reflection of the product innovation with the introduction of compact disc players, video cassette recorders, new electronic and cellular telephones, as well as of the resulting increasing demand for microstructures to manufacture these goods. In contrast, for the electronics goods for which no major technological innovation was enforced in the 1980s, trade growth has been relatively moderate. This has been the case for microphones, loud-speakers and amplifiers which only have had an average annual growth rate of less than 6 per cent , radiotelephonic transmitters (7 per cent), television tubes (9 per cent) and television sets (10 per cent). These products have all faced the difficulty of expanding in a saturated market. Major innovations in the digital processing of audio and visual signals in the mid-1980s, however, augur well for a boost in trade in television sets and radiotelephonic transmitters with the introduction of such products as HDTV and cellular telephones in the beginning of the 1990s. The slow expansion of trade in semiconductors, despite the introduction of major new products, such as the 32-bit microprocessor, the 256K RAM and the DRAM in the 1980s, has been the result of an over-saturated market in 1985 (after the large production boost of 1984) and the increased tendency to domestic and in-house consumption.

28. Japan was the only country which managed to run huge and increasing net exports for all these products throughout the period 1980 to 1987. This was the consequence of advances in Japanese technology and the competitiveness of Japanese electronics products on world markets as well as of favorable exchange rate shifts. In contrast thereto, the traditional net exporter positions of the United States and the United Kingdom have been eroded and turned into net importer positions for most products over the same period. In fact, the United States did not manage to remain a net exporter for any of the products after 1986, American products being unable to compete because of the high United States dollar, and often also at the technological level.

29. The fight for market shares was very fierce throughout the period. It was marked by Japan gaining market shares at the expense of the United States (which has been the big loser) and of the European countries. The Asian NICs, Mexico and Malaysia managed to maintain or even expand their market share at the expense of each other and developed countries. These trends are reflected at the product level. Japan lost part of its market share in the sound and picture recorder and reproducer market which was marked by rapid product innovation, at the expense of the Federal Republic of Germany and the Republic of Korea. This was partly due to an increase in competitiveness of the electronics industry in these countries but also, particularly for the Federal Republic of Germany, to a relocation of Japanese production units into these countries. Competition was most intense in the telephone market where the traditional net exporters France, the Federal Republic of Germany, Japan and Sweden were joined by Taiwan Province of China in 1981 and the Republic of Korea in 1985; while Italy, the United Kingdom and the United States turned into net importers respectively in 1985, 1983, and 1982. After 1986, Hong Kong managed to reestablish its net exporter position which it had lost in 1983.

30. Developing countries gained exports shares primarily in electronics goods with a slow rate of technological innovation. This is the result of industrial countries moving out of the production of such products while developing countries are taking over. Most of the developing countries which were successful in expanding their share in electronics exports built this expansion on very few products only. Despite this , the majority of these countries tended to broaden their product spectrum of electronics exports throughout the 1980s. Some of them, however, such as the Philippines and Malaysia, continued to remain highly dependent on one or two products. At the product level this resulted in Japan and the other developed-country exporters losing part of their market share in products of the most stagnant or lower part of the technological ladder (i.e., TV sets, microphones, loudspeakers and amplifiers and TV tubes) while the Republic of Korea, Taiwan Province of China, Malaysia and Mexico emerged as new net exporters of such products after 1984. Technological diffusion, lower wage and production costs, and a relocation of production units to these countries were the major factors responsible for this shift. Electronic microstructures, semi-conductors and parts for telecommunication and sound recording apparatus

4 See also table 4.

constitute an important part of total electronics exports in many developing countries, particularly in the Philippines (with 87 per cent). However, their share tended to diminish in some countries. In Mexico it dropped most sharply, falling from more than 85 per cent in 1980 to less than 45 per cent in 1987. This is the result of countries engaging in the production of more advanced goods. So, for example, Malaysia and Mexico moved into the production of radios and televisions, which was negligible in 1980.

III. PRODUCTION

A. Major trends and actors

31. World production of consumer electronics goods and parts has followed a relatively differentiated path during 1980s. Production of transistors has had the most rapid expansion with an average annual growth rate of 25 per cent, followed by telephones with 11 per cent, television sets and sound recorders with 5 per cent, and electronic tubes with about 3 per cent. In contrast, the production of radios and sound reproducers has been shrinking by on average 3 per cent per annum.[5]

32. On the product level, the strong expansion of the transistors output, which to a large extent relies on the increase of Japanese production, is essentially the result of an increase in the output of electronic products which all have transistors as an essential component. It occurs in an environment of growing world demand. The same climate prevails for telephones, for which most of the production increase has been confined to Hong Kong. For the other products, demand is near to saturation and is stagnating in the major consuming countries. These shifts in the demand pattern explain the movements in production. The best example of this is provided by television and radio output.The rise in TV set output and the fall of radio output is essentially the result of the change of the Chinese production for these goods, the output of other producing countries remaining stable. In China the market for radios has been saturated since the beginning of the 1980s and has not provided a large scope for expansion anymore: this is reflected by a constantly declining output. The market for TV sets has, however, shown itself to be huge still, which makes for expanded production. Apparently, it seems that the Chinese radio producers, with their acquired know-how, moved into the production of television sets to fill the large demand gap. The production figures are summarized in annex table 5.

33. Production is concentrated on a few countries and territories only, among which China, U.S.S.R., Japan, the Republic of Korea, and the United States are the major ones, followed by Brazil, France, the Federal Republic of Germany, Hong Kong, Italy, Malaysia, the United Kingdom and Singapore. However, the relative strength of each country depends on the specific consumer electronics product being considered.[6] The common feature of all these producers is that they build their strength on an important domestic market. While some of them, as noted above, are export-oriented, Brazilian, Chinese and Soviet consumer electronics production is essentially used to supply the domestic market.

34. Most developing countries' electronics producers are export-oriented. The value added of their production varies greatly from country to country depending on the degree of technological know-how they master. In technologically least advanced countries, electronics production value added mainly results from the use of labour for very basic tasks and for the mere assembly of imported parts. These activities generally take place in special economic zones which are not integrated in the local production base (e.g. Malaysian wafer production in the export processing zone, or Mexican maquiladoras). In more advanced countries, electronics production value added results from the manufacturing of parts and eventually the processing of these parts into finished products. Value added derived from research activities generally remains confined to the most advanced countries and territories such as Hong Kong, the Republic of Korea, Singapore, Taiwan Province of China and developed countries.

---

5 The discussion is based on the products for which world production data from UNIDO were available. The world production excludes several countries and territories for which UNIDO does not collect data, among which Taiwan, Province of China. See also table 5.

6 In fact, it is difficult to assess the real importance of a country in world production because important countries often do not report. This is the case for transistors where, for example, the United States does not report any data. This situation casts some doubt on the accurateness of world share interpretations.

B. Factors underlying structural change

35. Shortening product cycles (dropping to less than 11 months for several electronics products)[7] calling for rapid development of new product designs and products as well as volatile consumer preferences prevailing in the electronics market have led to intense competition among electronics companies.

36. The adjustment pressure has become much stronger during the 1980s because of the shortening product cycles and the increasingly rapid diffusion of technology which enables competitors to successfully imitate innovations very rapidly.[8] To illustrate the importance of these phenomena it is worth mentioning the example of the telecommunication sector.[9] In the 1950s R & D expenditures for a product having a cycle of about 25 years amounted to $ US 10 million. In the 1960s and 1970s these expenditures rose to $ US 200 million while the cycle of related products fell to a range of 12 to 15 years. In the 1980s the R & D expenditures amounted to $ US 1 billion while the cycle of related products shrank further to 8 to 12 years. In economic terms this implies that a company, in order to amortize such R & D costs, has to ensure a world market share of about 8 per cent. In the 1990s, the introduction of I.S.D.N. (Integrated Systems Digital Networks) will require a world market share of about 16 per cent.

37. The consequence of this process is that technology has emerged as the foremost driving force of competition.

38. New production and organization techniques emerged, essentially imposed by the tightening competition with leading Japanes firms: the just-in-time production to reduce inventories; the cell production to reduce production leads and increase flexibility and spatial fragmentation of the production process; the integration of design and manufacturing departments at the initial design stages to improve the manufacturing decisions and to increase the links between perceived customer desires and the development and distribution of products; and the increased delivery frequency.[10] These techniques led enterprises to reformulate their production and marketing policies and to develop new strategies for their rationalization plans.

39. The prevailing environment, characterized by an eroding United States dollar in terms of other major hard currencies and rising protectionist pressures particularly against Japan but also against the Republic of Korea, Hong Kong and Singapore, has speeded up the relocation process of production units. This, as well as wage cost differentials, led several Japanese companies to set up plants in dollar-pegged countries of South and South-East Asia. In fact, wage differentials have been a major factor for the emergence of developing countries as electronics producers and particularly for the emergence of Indonesia, Malaysia, Mexico and the Philippines in the 1980s. In the United States the wage level has remained highest throughout the 1980s followed by Japanese and European wages which have been almost as high. These countries experienced tendentially increasing wage rates during period. The wages prevailing in developing countries have been significantly lower-highest in Singapore (where they have continuously risen) and the Republic of Korea (where they had been stagnating before rising rapidly in recent years), and lowest in Indonesia and the Philippines. The wages of the two latter countries are less than half of those prevailing in the Republic of Korea, which explains why these countries are becoming increasingly attractive for NICs as offshore production bases.

40. It is notable that, as far as developing countries are concerned, the impetus for adustment in the electronics industry did not stem so much from local factors as from the strategies of leading electronics companies. These companies frequently use production in developing countries to reduce their production costs and remain competitive at the international level, with respect to their finished or core products. Major reasons for rapid development of production and exports in de-

---

7 See Joncquieres (1989) or OECD (1989c), p. 65 and p. 115f.

8 This speed rose from a couple of years in the 1950s and 1960s to a few months only in the 1980s. See OECD (1989), April 89, p. 65.

9 For more details see Van der Klugt (1988), p. 2. Similar tendencies also apply for the electronic component sector.

10 See Leadbeater (1989).

veloping countries have been: the increased adoption of spatial fragmentation of production which made the relocation of specific parts of the production process possible only for TNCs; the low labour costs which made the relocation of certain labour-intensive parts of the electronics production processes attractive; the rapid maturation of electronics products which made of the relocation of sunset products to developing countries a technologically less sensitive issue for TNCs; and the lower involvement of many developing countries in trade frictions.

C. Adjustment policies

41. The electronics industry, particularly in the field of consumer electronics, is undergoing a period of structural change marked by rationalization and regrouping. This is the result of shifts in demand, trade patterns and technological advances, as well as the factors discussed in the previous section. The short product cycles within saturated markets and an environment of changing consumer preferences lead to fierce price competition among enterprises. It forces companies to adjust their production to the new levels and structures of demand and to cope with the pressures ensuing from shifting comparative advantages among countries. They responded to these pressures by:

(1) constantly searching for new products through technological improvements and innovations;

(2) increasing productivity by rationalization; vertical integration or mergers; overseas production; increasing the flexibility of production;

(3) improving their market penetration by internationalized production, setting up production units either through direct investment, participations or mergers in major consuming countries; and

(4) increasing inter-firm co-operation, particularly in the areas of R & D, international marketing, and subcontracting.

42. These adjustments have been related principally to the areas of technology, production strategy and employment.

1. Technology-related adjustment

43. Technology, as the foremost force driving structural adjustment in the electronics industry, has led to both product innovations and price cuts. In the 1980s, the progress achieved in digital processing of audio and visual signals as well as in the data storage support miniturization resulted in the introduction of new products, such as the compact disc player, the digital and cellular telephone, and the HDTV, at competitive prices. These new products tend to push traditional products out of the market and thus put a high pressure on enterprises to adjust.[11] The adjustment pressure has become much stronger during the 1980s because of the shortening product cycles and the increasingly rapid diffusion of technology.

44. Companies have adjusted to this environment by allocating increasingly larger budgets to R & D and emphasizing on research personnel in the 1980s. This is reflected, for example, by the importance of R & D expenditures as percentage of total revenues which in 1986 ranged between 11.6 per cent and 5.4 per cent for the ten top data processing companies.[12] In addition, the trend of enterprises R & D expenditures in electronics equipment and components from 1980 to 1984 showed a strong and continuous progression for United States and Japanese firms as opposed to an irregular stop-and-go path for EEC firms.[13] The trend captures the increased tendency for

[11] The pushing out process coincides with the overlaping of product cycles, one product being in the stagnation-decline stage while the other is in the expansion phase.

[12] See OECD (1989a), Table A2.1, p. 182ff.

[13] Data on this process are scarce and often unreliable (see OECD (1989a), p. 98ff.). See also table 6.

internal research which emerged in United States and Japanese firms in the early 1980s already. However, it is not able to reflect the change in attitude of European firms because it occured somewhat later. Until about 1985 European firms preferred to acquire advanced technology through other arrangements than in-house basic research. European firms also showed an increased tendency to enhance R & D coordination within the fragmented EEC market, but only after the mid 1980s. Lately, electronics firms (among which IBM) have also begun to put more emphasis on the efficiency of R & D and its ability to yield marketable products than on the amounts spent on R & D. This has led them to develop new strategies for R & D such as the identification of customer-suggested improvements to product shortcomings and their integration into the production process.[14] Figures of R & D expenditures are summarized in annex table 6. In addition, the increased importance of R & D and the extent of such expenditures has also led companies to widen their scope for economies of scale and to intensify co-operation, even with competitors. That has generated a further concentration and internationalization of the electronics industry.

2. Production strategy adjustment

45. Firms of the electronics industry have not exclusively relied on technological innovation to survive in the increasingly competitive environment of the 1980s. They have also sought to improve their productivity and to cut costs in order to maintain lower prices. Many firms have undertaken rationalization programmes to improve their internal organization and to adjust it to the new environment.

46. This has led most firms to revise their essentially nationally-oriented strategies and to increase internationalization of production. The change of firm strategies has transformed the electronics industry into the most internationalized sector of manufacturing in the 1980s, with three major repercussions. First, production and competition have expanded from the national to the world scale. Secondly, the geographic location of production facilities is no longer bound to the firm's home country but cost efficiency and consideration of consumption markets have become major determinants of the choice of production location. Thirdly, the exposure of firms to trade policies and exchange-rate fluctuations of and vis-à-vis major producing and consuming countries has increased drastically since they have directly affected the firm's performance on the world market. This has resulted in an overall concentration of the structure of electronics firms at both the national and international levels, to an enlargement of overseas production, and to the adoption of more flexible production techniques.

47. The concentration process has been reflected in international mergers and in take-overs of entire competing corporations or parts thereof. This practice, adopted to achieve economies of scale, rationalization and access to technologies, has been widely adopted by United States and European firms. The European electronics industry has been particularly affected by the concentration process. One of the most striking events in this process was the breakdown of AEG-Telefunken in the late 1970s and the take-over of parts of its activities by Philips (Netherlands) and by Siemens (Federal Republic of Germany). More recent merger or take-over examples were those of the French Compagnie Générale de Construction Téléphoniques by the Swedish telecommunication firm Ericsson at the beginning 1987, and of the English Plessey by the Anglo-German tandem General Electric Company and Siemens in fall 1989. These examples illustrate both prevailing tendencies: one for a higher vertical integration and specialization, and one for a diversification in the field of electronics. European governments play an important role in this concentration process, major take-overs being under the scrutiny of cartel commissions and subject to government approval. They have generally slowed down the concentration process.

48. The need to operate on increased scale of production has led electronics firms to increase their investments. In all the major producing countries the trend of fixed capital formation has been going upward in the beginning of the 1980s despite of some important breakdowns in 1985 or 1986. The most significant increases have been realised in the Federal Republic of Germany, Japan and the United States. There has also been a marked tendency to use an increasing share

[14] See The Economist, Sept. 3 1988, pp. 62-64.

of profits for investment purposes.

49. The desire to reduce costs and to avoid negative effects of exchange rate shifts has led major electronics firms to increase foreign direct investment in developing countries and, particularly in the NICs. In this process they have relocated labour-intensive parts of the production process to such countries in order to benefit from the lower labor costs (see also table 7). In the Republic of Korea, for example, foreign investments in the electronics industry rose from an annual average of about $ US 17 million in the early 1980s to $ US 55 million in 1985 and to more than $ US 100 million in 1986.[15] In Taiwan, Province of China, the cumulated foreign investment in the electronics industry between 1974 and 1985 amounted to more than $ US 1.1 billion.[16] The major investors are United States, Japanese and European firms such as AT & T, IBM, NEC, Alps, Siemens etc.

50. To gain access to foreign markets and to surmount the increasing trade barriers, electronics firms have also been shifting increasing amounts of investment in major markets located in developed countries. Foreign investment has been particularly vigourous in Europe and the United States, while it remained relatively weak in Japan. In the early 1980s, United States and Japanese companies set up large production capacities in European countries. They are now followed by some NICs such as the Republic of Korea, which invest in consumer electronics, components and assembly plants in other South-East Asian countries and Europe. At the same time, Japanese but also European and NIC firms increased their electronics investment in the United States.

51. Lastly, the adoption of new, more flexible production techniques in the electronics industry has been an important feature of structural adjustment. This has been a consequence of the rapidly changing demand and technological environment and the increased extent of initial costs in setting up new production capacities. The core of the adjustment relates to an outstanding increase of co-operation among electronics firms, particularly at the international level. It is reflected by a significant increase of joint ventures, licensing, second-sourcing, sub-contracting, production capacity sharing, technical and marketing arrangements among firms during the 1980s. Most of the co-operative production techniques involved firms in developing countries.

3. Adjustments in employment

52. The changing strategies of firms, the pressure to rationalize and the growing importance of technological progress has had a significant influence on the employment requirements of the electronics industry. The new environment brought about an increased need for highly skilled personnel, a drop in the demand for unskilled workers, a shift of the amount of labour to more advanced production segments and a shift of labour-intensive parts of the production process to low-wage countries and, thus, a shift in the international division of labour in the sector.

53. The importance of R & D and the adoption of automated manufacturing techniques have resulted in a greater need of highly skilled personnel to develop new products and new production techniques, and to operate the more sophisticated machines used in the production process. The ensuing increase of the capital-intensity of the electronics manufacturing process has caused a drop in the demand for unskilled workers. However, the growing importance of the need to react rapidly to changes in the market has led to a higher demand for managerial and administrative staff. The simultaneous occurence of both phenomena has caused a shift of the personnel into higher-skilled operations.

54. The technological progress achieved in the manufacturing process and the rationalization measures implemented throughout the 1980s, principally in developed countries, have resulted in drastic increases of labour productivity in the electronics industry (see table 7). The highest labour productivity increases (in US dollar terms) have been achieved in Japan and European countries. They have, however, been determined by different factors. In Japan ouput increases and the appreciation of the Yen vis-à-vis the dollar have been the driving forces of its labour productivity

[15] See Chaponniere (1988), "Les nouvelles multinationales de l'electronique", Industrie et Développement, Oct. 1988, p. 513.

[16] See Chaponniere (1987), p. 66.

increase, while for the European countries rationalization and important labour force releases have been the major determinants.

55. In developing countries, high labour productivity increases have been achieved in Mexico and Singapore. In these countries rationalization and important labour force releases have been the major determinants of the labour productivity increase. It is also notable that the lowest labour productivities have consistently corresponded to the internationally lowest wages rates. Despite progress realised in many developing countries, the labour productivity gap with major developed electronics producing countries has generally been widening. This is due to unskilled labour-intensive parts of the production process shifting out of the developed into the developing countries.

56. The level of employment has also been changing drastically in developed countries in the entire electronics sector. In certain European countries the labour force has stagnated or tended even to shrink, while it has grown strongly in Japan and the United States.[17] In consumer electronics and telecommunications, the EEC industry lost more than 116,000 jobs between 1980 and 1987. Unskilled workers were most affected by these jobs suppressions. In contrast, Japan and the United States succeeded in creating 188,000 and 55,000 jobs respectively from 1982 to 1986.

57. In developing countries the level of employment in the electronics industry tendend to increase, particularly in South and South-East Asian countries as a consequence of the relocation of labour-intensive parts of the manufacturing process. Unskilled workers have benefited most from this job creation. At the same time, the employment in the electronics industry became extremely volatile in these countries because of the increased volatility of demand, and recessions causing large labour layoffs (e.g. 1981, 1985).

[17] See The Economist, Jan. 14 1989.

IV. GOVERNMENT AND STRUCTURAL ADJUSTMENT

58. Governments have intervened increasingly into the adjustment process of the electronics industry. They used several instruments for this purpose: trade regulations (tariffs and non-tariff measures), anti-trust regulations, foreign investment regulations, direct subsidies or tax incentives, research programmes, and government procurement. This section reviews the major instruments used in the main producing and consuming countries with respect to the development of the electronics industry.[18]

A. Trade policies

59. Trade policy is used by major producing countries to protect their domestic producers. The trade policy arsenal is growing and includes tariff retaliations, product reclassifications, bilateral trade negotiations with strong commercial partners and Non-Tariff Measures (NTMs), such as Voluntary Export Restraints (VERs) and Orderly Marketing Arrangements (OMAs).

60. The 1980s have been marked by a shift away from tariff protection to non-tariff measures, particularly in the countries which have been losing their comparative advantage in the electronics sector, i.e. Europe and the United States. The post Tokyo Round tariff rates for electronics products have been decreasing. They ranged from 0 per cent to 19 per cent in major developed market economies, being highest in the EEC and lowest in Japan. The use of NTMs, OMAs, VERs (see table 8) and tariff retaliation (see table 9) has followed different paths in the major electronics consumer countries.

1. European Economic Community

61. Most European countries, with the notable exceptions of the Federal Republic of Germany and Ireland, have consistently been running trade deficits in electronics in the 1980s. These deficits have tendentially widened during this period. This situation is due to a lack of dynamism, a relative technological backwardness of consumer electronics firms, and the fragmentation of the European market: this factor limited the scope for economies of scale, thereby disadvantaging European firms in the intensifying international competition.

62. Following the Tokyo Round (TR) Agreement, European countries have been progressively reducing most of the tariffs on electronics products during the 1980s. However, there have been specific and product-selective tariff increases for several products showing a rapidly growing import penetration (CD players, VCRs and semiconductors). This has made tariff protectionism one of the principal sources of trade friction between the EEC on the one hand and Japan, the Republic of Korea and Taiwan Province of China on the other hand.

63. Anti-dumping inquiries and duties have been the major tool of the EEC tariff protectionism. Such inquiries have been conducted against Canada, Japan, Hong Kong and the Republic of Korea, and duties have been levied on several finished electronics goods originating from Japan and the Republic of Korea (see table 8).

64. This has encouraged firms in the two latter countries to establish production and assembly bases in the EEC, sourcing a large part of their components from their home country. The reaction of the EEC has been to impose "personalized" unit duties on the products of these foreign

[18] For details see also Hieronymi (1987), Humbert (1988), Kazis (1988), and Kostecki (1989).

manufacturers. The Republic of Korea was also removed from the generalized system of preferences (GSP) at the end of 1987. VERs have been negotiated with Japan on TV tubes, VCRs, CD players and other sound reproducers. Several European countries (particularly Spain, France and Italy) have used national NTMs to limit the electronics imports. Non-automatic licences and import quotas are the most commonly used measures to protect the domestic electronics industry. The products concerned are essentially semiconductors, electronic components, telecommunication equipment and technically sophisticated products as well as VCRs.

2. Japan

65. Japan's trade balance in electronics has steadily been improving throughout the 1980s as a consequence of the low level of imports and rapidly increasing exports. The trade policy conducted by MITI in the 1980s has been more reactive to external pressures than active. It has essentially been geared towards opening domestic markets to world competition.

66. The progressive liberalization of Japanese trade policy in electronics during the 1980s contrasts with the strongly protectionistic policy with respect to the entrance of foreign goods followed by the MITI from the 1950s to the 1970s. It has been partly conditioned by the low competitiveness of foreign electronics products in the Japanese market and partly by the pressure of major electronics deficit countries - for example the United States and the EEC - for improved market access conditions.

67. The liberalization policy is characterized by a progressive reduction of the relatively high tariff rates prevailing for electronics products in the late 1970s to very low levels as compared to those of the EEC and the United States. This has been implemented within the Tokyo Round Agreement. During the 1980s, Japan has not, unlike to other countries, made use of any standard NTM to impede the penetration of foreign electronics products in the Japanese market.

68. To reduce the trade frictions with the major electronics deficit countries, MITI has initiated a policy to promote imports of foreign semiconductors. This has led to the conclusion of purchasing commitments for electronics goods between United States and European producers on the one hand, and Japanese electronics firms on the other.

3. United States of America

69. Since the beginning of the 1980s, the American trade balance in electronics goods has constantly been worsening, partly because of the strengthening United States dollar and partly because of the intensifying international competition. This has led the United States authorities to react and to tighten their trade policies in order to protect their threatened domestic electronics industry.

70. American protectionism in the electronics industry has particularly increased in the second half of the 1980s. In the wake of the Tokyo-Round Agreement there has been a general reduction of the tariff rates applied to most electronics products except for some colour TV parts for which there has been no change as compared to the pre-Tokio Round rates. At the same time, however, increased use has been made of retaliatory tariffs against some products orginating from Brazil and Japan. Anti-dumping duties have also been levied for several products originating from Canada, Japan, the Republic of Korea, Singapore and the United Kingdom (see table 9).

71. With the adoption of the Harmonized System (HS) in 1988, several electronics products - such as circuit boards - which previously belonged to duty-free classes have been reclassified into dutiable classes. VERs have been negotiated with the Republic of Korea on TV sets and VCRs. OMAs have been concluded with Japan and the Republic of Korea for semiconductors. The most spectacular protectionist measure in this regard has been the OMA with Japan. The United States-Japan Semiconductor Agreement is monitoring costs and prices of Japanese exports not only to the United States but also to third countries, and is establishing improved market access conditions for foreign producers in Japan.

4. Developing countries

72. Several developing countries, in particular the Asian NICs, have emerged as electronics net exporters during the 1980s. This has not so much been the consequence of protectionist measures limiting imports as of the expansion of domestic output and the relocation of electronics production units from industrialized countries. The trade policy trends during the 1980s have been relatively differentiated among developing countries, ranging from high and increasing protectionism to a full liberalization of imports.

73. Most developing countries and territories, except Hong Kong and Singapore, have maintained higher tariff protection for electronics products than the EEC, Japan or the United States. Several countries and territories such as the Republic of Korea and Taiwan Province of China have progressively reduced tariffs on major electronics goods, partly under foreign pressure. Most developing countries have also made a prominent use of NTMs and in particular of non-automatic import licenses and import prohibitions for electronics. In 1986, Taiwan Province of China replaced the total import prohibition of major consumer electronics (among which colour TV sets and VCRs) by very high import tariffs, thus taking steps towards a more transparent import regime. Brazil, on the contrary, under its Informatics Law (Lei da Informatica), has prohibited imports of most electronics goods since 1984. The restrictions imposed by this law are planned to be removed after the end of the 1980s. Several developing countries and territories (Hong Kong, the Republic of Korea and Taiwan Province of China) have also been forced to limit their exports through VERs.

B. National industrial policies

74. National industrial policies have been used in all the major producing countries to strengthen and promote the development of their electronics industry. These policies comprise competition laws, government fundings of industrial R & D, grants, loans, purchase orders and protected supplier positions, foreign investment codes.

75. In the 1980s, the most popular instruments in this regard have been large government supported programmes to stimulate R & D and more flexible anti-trust laws. The period is notable for a strengthening and revival of government-financed research and a change in the authorities' attitude in favour of increased inter-firm co-operation and deregulation. Again the use of these instruments is reviewed for the major countries involved in the production of electronics.

1. European Economic Community

76. Industrial policies for the electronics sector are relatively recent in Europe (see also table 10). They are following two major lines. A first line consists of national support measures such as subsidies, research programmes and national competition policy. A second line relates to research co-ordination among European firms in the framework of supranational programmes.

77. During the 1980s, government support measures for R & D in most European countries have been strengthened, essentially to permit the national electronics industry to become more competitive in the future. The Federal Republic of Germany launched in 1984 a DM 3 billion plan for unified information technology. In France, there was an extremely strong and sustained intervention by the Government in the electronics industry during the first half of the 1980s. The State took control of or nationalized all the major electronics firms (CGE, Thomson, Saint-Gobain, Bull, Matra) and launched the PAFE (Plan d'Action Filière Electronique) to recover a competitive technological level and increase output in 1983 within a four-year plan of FF 140 billion. In the United Kingdom, public authorities launched the £ 200 million ALVEY programme in 1984 for R & D in advanced computers. In this country, guaranteed defence contracts have also played an important role, making United Kingdom electronics firms reluctant to enter civilian sectors of electronics production.

78. At the same time as they increased public funding of research in electronics, authorities have tended to reduce their direct control over the electronics industry during the latter half of the 1980s. This has been reflected by the successive privatization of State-controlled firms in France and the United Kingdom and deregulation of supply monopolies in the Federal Republic of Germany, with the aim of increasing the dynamism of the industry by relying more on private decision-making and reinforcing intra-European competition. In the Federal Republic of Germany, the deregulation has, for example, eroded the near-monopoly supplier position of Siemens to the Bundespost. In France a privatization programme affecting most major electronics firms was launched in 1986. In the United Kingdom, public authorities have started selling or giving control of State enterprises (ICL, Ferranti, INMOS) to the private sector and have reduced the growth of defence contracts.

79. Competition policy towards the electronics industry is related to distribution agreements, permitted forms of enterprise co-operation, and the abuse of a dominant position as well as to merger controls. It is implemented at two levels. On the national level, the willingness of authorities to authorize mergers is increasing but the authorization process remains long. At the supranational Community level, the flexibility to permit joint ventures among large firms of the electronics sector is increasing.

80. A major innovation in the European industrial policy-setting of the electronics sector in the 1980s has been the emergence of supranational research programmes. The principal aim of these programmes is to co-ordinate research among European electronics firms, avoid duplication and set up research associations even among competitors in order to benefit from know-how synergies, enlarged financial resources and the economies of scale provided by the prospect of the enlarged European market. In 1984 ESPRIT (European Strategic Programme for Research and Development in Information Technologies) was launched with a budget of ECU 750 million until 1988. Its success has been such that it called for the launching of ESPRIT II in 1987 already, with a budget of ECU 1.6 billion. While ESPRIT gave more emphasis on fundamental research, ESPRIT II gives a larger emphasis to product applications, remaining, however, in the pre-competitive research in order to avoid coming under the scrutiny of the anti-trust authorities. The principle of the programme is a 50 per cent contribution to private inter-European R & D projects (see table 11). Other similar programmes stimulating research and co-operation in the electronics industry are EUREKA, RACE and BRITE.

2. Japan

81. Japanese authorities have a long tradition in guiding and promoting their national electronics industry. The MITI (Ministry of International Trade and Industry) has, in the past, provided important protection against foreign competitors, and favorable conditions stimulating competion among Japanese electronics firms and growth. Its major lines to promote the electronics industry are threefold. First, it stimulates competition among Japanese firms. Secondly, it leaves marketing and product decisions to the firms. Thirdly, it encourages large ventures, which makes for major economies of scale.

82. During the 1980s, there has been no shift in this policy. Thus, as opposed to EEC and United States, financial participation of public authorities to R & D efforts has remained very low in Japan. The "Law for the Promotion of Specific Machinery and Information Industries", enacted in 1978 and determining the role of MITI in the electronics industry, was abolished in 1985 without being replaced. While that law was in force, MITI had promoted numerous joint activities among electronics firms which were exempted from the anti-monopoly law, such as co-operative R & D. MITI also issued several contracts to private electronics firms either directly or through NTT (Nippon Telegraph and Telephones). MITI provided guidance and assistance to Japanese electronics industry by launching several research programmes itself or under the aegis of the Science and Industrial Technology Agency.

3. United States of America

83. Several national policy measures have been aimed at the development of the electronics industry in the United States. A first range of policies consisted of increased government funding of research programmes for the electronics industry. A second range of policies are designed to increase the flexibility of the legal framework and, in particular, anti-trust regulations in order to allow the national private sector to co-operate more easily. A third range of policies aims, through anti-trust laws, at reducing the increase of foreign ownership in strategic areas of the electronics sector.

84. During the 1980s, there has been a revival in the United States Federal financing of research in electronics. This is a reaction to the progress made by the Japanese electronics industry during the 1970s, a period marked by low public expenditures for electronics research purposes in the United States. The two major actors have been the Department of Defence (DD) and the Defence Advanced Research Projects Agency (DARPA). Several new research programmes were launched in early 1980s, the most famous being the Strategic Defence Initiative (SDI) in 1984 and the Very High Speed Integrated Circuit (VHSIC) in 1980 (absorbed by the SDI in 1984) both by the DD. The SDI have allocated about $ US 25 billion for research purposes in the period from 1984 to 1990. The DARPA has also started a programme of $ US 1 billion in the same period in 1984: the Strategic Computer Program. In addition to purely research related programmes, the DD has also launched programmes to ensure the competitiveness and independence of the national electronics industry: it supports SEMATECH with $ US 250 million and SMTI with $ US 200 million annually. SEMATECH aims at helping the American Semiconductor Industry Association to develop and manufacture most technologically advanced electronics components. SMTI aims at helping to set up a consortium of high-technology firms which develop and manufacture sophisticated electronic devices.

85. In the 1980s, there has also been a shift in the attitude of the United States authorities towards more flexibility in enforcing the prevailing competition laws. This is essentially due to the increasing amounts required for R & D in the electronics industry in order to remain competitive It has allowed the growing practice among electronics firms of regrouping in associations to share R & D costs, to co-ordinate research carried out in private or university laboratories, and to place fundamental university research at the service of the industry. In the fall of 1984, the National Cooperative Research Act gave legal status to this type of inter-firm co-operation, which was in contradiction with the previously prevailing anti-trust laws. Furthermore, the Federal Technology Transfer Act of 1986 gives United States firms privileged access to firms to fundamental research work from United States university laboratories. At the same time, however, the authorities also used anti-trust regulations to forbid major foreign competitors to purchase or control strategic production units of the electronics sector. This was, for example, the case with the attempt of Fujitsu to control Fairchild in March 1987.

4. Developing countries

86. In developing countries, electronics policies were very different among countries.[19] While certain countries built initially the development of their electronics industry on the internal market and on import substitution (e.g. Argentina, Brazil, China, India, Mexico), others based it on attracting the relocation of production units by transnational companies (TNCs) and export-oriented production. In the latter group there is a distinction between the countries and territories which successfully absorbed the initial foreign technology to build up an integrated national electronics industry (Hong Kong, the Republic of Korea, Singapore and Taiwan Province of China) and the countries which attained a high export growth and competitiveness through sub-contracting of parts and components production by TNC subsidiaries without having been able yet to build up a strong national electronics industry and to integrate such operations into their industrial structure (Malaysia, the Philippines, and Thailand).

87. The first group of countries suffers from a very poor local mastery of foreign electronics

[19] For the following classification see also Lall (1989) or UNIDO (1989).

technology and a poor learning process, which prevent local firms from keeping pace with world technological progress in electronics. The Governments of these countries consequently launched measures to promote local electronics centres to develop and disseminate technologies. Some of them also liberalized foreign investment regulations. Many practiced a policy of "reserved markets" for local producers, the most extreme example of this being Brazil with its Lei Informatica of 1984.[20] The national industrial policies of these countries have generally been complemented by restrictive trade measures to protect the local electronics industry. Over the 1980s there was, however, a frequent tendency to reduce tariff and non-tariff protection.

88. The second group of countries has rapidly gained experience with local integration of operations by branches of foreign firms, joint-ventures, local sub-contracting for foreign enterprises and diffusion of technology to the domestic sector. The governments of these countries promoted interaction between local and foreign firms, acquiring know-how in more complex stages of processing than the mere assembly of parts, and developing their own local electronics industry.[21] Major instruments used for this purpose have been: the liberalization of foreign investment codes with provisions to ensure a minimum level of technology transfer and local integration of processing and a minimum share of production to be exported; the expansion of export processing zones (EPZs), special electronics areas and scientific parcs. Incentive measures were also adopted to induce local firms to engage in joint-ventures with foreign firms, OEMs, and other technology sharing and marketing arrangements with foreign electronics enterprise. State enterprises and public research and technology centres became important instruments for support to the electronics industry. These measures were also complemented by trade protection against foreign competitors. The tariff and non-tariff proctection has been progressively reduced over the 1980s, essentially under external pressures but also because of the increasing use made by local producers of outward processing in lower wage countries.

89. The third group of countries has been confronted with the dilemma of continuing to attract foreign investors while accelerating the local integration of highly technical production processes of the subsidiaries of foreign electronics firms established in EPZs in order to overcome their role of mere assemblers of parts. The instruments used for this purpose have been: the creation of new and the expansion of existing EPZs; the liberalization of foreign investment codes with provisions of minimum local content; the encouragment of OEMs by low wage policies and joint-ventures with foreign electronics companies by increasing the flexibility of regulations to allow foreign majority ownerships; as well as the development of international transportation infrastructure.

90. For most developing countries there has been continuity in the industrial policies towards the electronics sector during the 1980s as compared to previous periods, except for Brazil which has introduced major changes. A general feature of most developing electronics producing countries was, however, that they increased the priority attributed to the development of the electronics industry as compared to other sectors during the 1980s. Another common feature to most of these countries is that they practise some kind of infant industry policy to promote the development of their electronics industry. This policy was mainly based on financial assistance, foreign investment regulations and high protection against foreign competition. Extremely large discrepancies prevailed, however, among the countries in the implementation of their infant industry policies for electronics, particularly in their major action line, the treatment of foreign investment. To give an insight into the variety of approaches used in this context by developing countries in the 1980s the relatively most liberal territory (i.e., Taiwan Province of China) and of the most restrictive country (Brazil) are briefly discussed.

91. During the 1980s, there has been a liberalization of foreign capital inflow regulations in most developing countries with the exception of Brazil. Taiwan Province of China launched a ten-year plan for the electronics industry in 1979. This plan provides for a large set of financial and fiscal incentives for national electronics firms to invest and increase R & D. The R & D effort of private firms has also been supported with the assistance of two government agencies: the Electronic Research Scientific Organization (ERSO) and the Institute for Information Industry (III). Both have been very active throughout the 1980s, ERSO conducting own research projects disseminated to or directly assisting private firms in their research and III promoting and co-ordinating private R & D projects. Taiwan Province of China has also conducted a very liberal foreign investment policy during the 1980s. In its effort to attract foreign capital, it has issued very liberal regulations

[20] See also Hieronymi (1987), pp. 85-100.

[21] See also Hieronymi (1987), p. 83.

for the creation of foreign subsidiaries and joint ventures in the electronics sector. It also encourages original equipment manufacturing (OEM) contracts. In addition, it continues to develop its free trading zones and the Hsinchu Scientific parc. But in parallel, Taiwanese authorities have steadily increased both the minimum local content share and the minimum export share requirement for electronics companies with foreign capital during the 1980s.

92. Brazil, on the contrary, reversed its relatively liberal attitude towards foreign capital inflows in the electronics industry in 1984 with the adoption of the Informatics Law. The Special Secretariat for Informatics (SEI) is entrusted with the implementation of this law. The core principles of the law are to develop a purely national informatics technology and industry, and to provide the central Government with a very strong control over any industry making use of electronic components. Under this law, the Brazilian market has been restricted to Brazilian firms exclusively. The production of any good or service involving some electronics has been subject to the prior approval of the SEI which granted it exclusively to Brazilian national companies. Foreign electronics firms or firms with a foreign participation have lost the right to upgrade their products. Government procurement and R & D assistance is limited to Brazilian companies using Brazilian technology exclusively. As a consequence, many foreign electronics firms in Brazil have left or are in the process of leaving the country, and simultaneously freeze or reduce their investments. On the other hand, Brazilian electronics companies were forced to "reinvent the wheel", have lost scope for making economies of scales, suffer from a shortage of modern electronics products and components, are facing severe financial strains and are undercapitalized. This has led to some mis-allocation of capital resources and the growth of certain national non-competitive electronics production and enterprises.

V. POLICY OPTIONS FOR DEVELOPING COUNTRIES

93. The policy options for developing countries to strengthen or expand their electronics sector are principally governed by the level of development of their local electronics industry. In this connection it is of particular importance to know whether the country has already a well-established local electronics industry or whether it needs to attract foreign investors to build it up. Besides the abundance of cheap labour several factors are of major importance to attract foreign investment in the electronics industry.[22] These include: a stable and reliable labour force ready to accept long hours of accelerated working rhythms, low-cost working conditions and insurance. It is also necessary for host countries to offer political stability and accommodate forms of State intervention to create a positive business climate; base country legislations facilitating the re-import of off-shore operations under beneficiary conditions; absence of trade frictions between the host country and major markets; and transportation infrastructure allowing rapid and frequent connections to major consumption markets.

94. Countries with less integrated electronic industries often lack capital and skills to enter and develop an electronic industry on their own. The resulting policy priorities include the development of local skills and the reluctance to spend large amounts of domestic capital for setting up sophisticated production units. Their programmes for electronic industry development should therefore focus on attracting co-operation by foreign companies able to train local labour force, develop local know-how and stimulate foreign investments in the electronics sector. Several instruments could be used for this purpose. Export processing could provide the framework to attract foreign investment on a general base. Special tax and rebates for electronics firms could be used to attract enterprises of this specific sector to joint ventures and exports. Liberalization of foreign investment regulations with special provisions for export-oriented investments in the electronics sector could also be envisaged. Both instruments should provide for a large flexibility of the foreign company in setting up local production units, avoid red-tape obstacles, and insist on technical training of local staff and co-operation with local enterprises. The existence or development of an effective transportation infrastructure allowing for rapid communications with major markets would constitute an important asset.

95. The priorities of the more advanced countries, which already have a relatively strong electronics production base and skilled labour force, or even of those countries which are only engaged in assembly activities are different. They need to expand their market access to major consuming countries,[23] take advantage of economies of scale and gain access to the most recent technology. They also have to strengthen the technological diffusion within the country. Several instruments are at their disposal for expanding their market. Authorities could negotiate improved market access conditions for locally produced electronics goods with major consumer countries. This could be done by co-ordinating their positions on electronics products within the framework of multilateral trade negotiations. A more subtle way to gain access to highly protected electronics markets in major consuming countries would be to attempt to establish closer contacts between local electronics firms and companies of major consuming countries. Long-term contractual arrangements with such companies could be stimulated by regulations favouring international sub-contracting through tax incentives. Another option would be to stimulate sub-contracting of national firms with electronics firms established in local EPZs. Special tax rebates could be granted to foreign and domestic companies engaging in such contractual arrangements. The experience of major developed countries with schemes for R & D promotion showed that they can significantly contribute to the development of the electronics sector. Programmes to stimulate and co-ordinate co-operation among local electronics firms could be important instruments to achieve this objective.

---

[22] See also Scott (1987), p. 144f.

[23] This aspect is particularly important because of the general trend towards rising protectionism, bilateralism and managed trade in high-technology sectors in developed countries. See OECD (1989b), p. 80.

REFERENCES

(1) Chaponnière J.P. (1988), "Les nouvelles multinationales de l'électronique", Industrie et Développement International, Oct. 1988, pp. 513-518.

(2) Chaponnière J.P. (1987), "L'industrie électronique à Taiwan", Industrie et Développement International, Feb. 1987, pp. 61-70.

(3) Commission of the European Communities (CEC) (1988), Panorama of EC Industry 1989, Brussels and Luxembourg, CEC 1988, Chapter 12 and 13, pp. 12/5-12/17 and pp. 13/27-13/36.

(4) Hieronymi O. (1987), The Domestic and External Impact of National Industrial Policies: The Example of the Electronics Industry, Geneva, Battelle 1987.

(5) Humbert M. (1988), Global Study on World Electronics, ID/WG.478/2(SPEC.), Vienna, UNIDO Dec. 1988.

(6) Joncquières G. de (1989), "A tortoise that stays within its shell", Financial Times, Oct. 30 1989, p. 13.

(7) Kazis D.A. (1988), "Post-War Industrial Policy and the Electronics Industry in Japan", Reports on Planning 41, Athens, Centre of Planning and Economic Research 1988.

(8) Kostecki M. (1989), "Electronics Trade Policies in the 1980s", Journal of World Trade Vol. xx(n), March 1989, pp. 17-35.

(9) Lall S. (1989), "Explaining Industrial Success in the Developing World", Ld'A-QEH Development Studies Working Papers No. 15, Sept. 1989.

(10) Leadbeater C. (1989), "Manufacturing Efficiency: Added Value Emanating from Acronyms", Financial Times, Dec. 13 1989, p. 11.

(11) OECD (1989a), Major R & D Programmes for Information Technology, Information Computer Communications Policy 20, Paris, OECD 1989.

(12) OECD (1989b), "Adustment Issues in the Electronics Industry", Science Technology Industry Review No. 5, Paris, April 1989, pp. 59-84.

(13) OECD (1989c), "Recent Developments in the Consumer Electronics Industry", Science Technology Industry Review No. 5, Paris, April 1989, pp. 113-128.

(14) Scott A.J. (1987), "The Semiconductor Industry in South-East Asia: Organization, Location and the International Division of Labour", Regional Studies, Vol. 21(2), pp. 143-160.

(15) UNIDO (1989), Strategies for Integrated Development of the Electronics Industry including Software, Issue Paper 1, ID/WG.491/1, Vienna, UNIDO Nov. 1989.

(16) van der Klugt C.J. (1988), "Management van een MNO tegen de achtergrond van de Japanse uitdaging", Philips 1988.

STATISTICAL ANNEX

Table 1: Correspondence between SITC Rev. 2, Rev. 1 and ISIC

SITC2	SITC1	ISIC	Descripition
76	724	3832	TELECOMMUNICATIONS & SOUND RECORDING APPARATUS
761	7241	383201	TELEVISION RECEIVERS
7611	n.e.	3832012	TELEVISION RECEIVERS,COLOUR
7612	n.e.	3832011	TELEVISION RECEIVERS,MONOCHROME
762	7242	383204	RADIO-BROADCAST RECEIVERS
7621	n.e.	n.e.	RADIO-BROADCAST RECEIVERS FOR MOTOR VEHICLES
7622	n.e.	n.e.	RADIO-BROADCAST RECEIVERS PORTABLE,INCL.SOUND REC.
7628	n.e.	n.e.	OTHER RADIO-BROADCAST RECEIVERS
763	89111	n.e.	GRAMOPHONES,DICTATING,SOUND RECORDERS ETC
7631	n.e.	n.e.	GRAMOPHONES & RECORD PLAYERS,ELECTRIC
76311	n.e.	n.e.	GRAMOPHONES,ELECTRIC,COIN-OPERATED
76318	n.e.	n.e.	OTHER ELECTRIC GRAMOPHONES & RECORD PLAYERS
7638	n.e.	n.e.	OTHER SOUND RECORDERS AND REPRODUCERS
76381	n.e.	n.e.	TELEVISION IMAGE AND SOUND RECORDERS,REPRODUCERS
76388	n.e.	n.e.	DICTATING MACH.AND OTHER SOUND RECORDERS
764	7249	3832	TELECOMMUNICATIONS EQUIPMENT AND PARTS
7641	72491	383210	ELECT.LINE TELEPHONIC & TELEGRAPHIC APPARATUS
7642	72492	n.e.	MICROPHONES,LOUDSPEAKERS,AMPLIFIERS
7643	n.e.	n.e.	RADIOTELEGRAPHIC & RADIOTELEPHONIC TRANSMITTERS
7648	*	n.e.	TELECOMMUNICATIONS EQUIPMENT
76481	n.e.	n.e.	RADIOTELEPHONIC OR RADIOTELEGRAPHIC RECEIVERS
76482	n.e.	n.e.	TELEVISION CAMERAS
76483	72993-4	n.e.	RADIO NAVIGATIONAL AID APPARATUS,RADAR APPARATUS
7649	n.e.	n.e.	PARTS OF APPARATUS OF DIVISION 76
76491	n.e.	n.e.	PARTS OF APPARATUS OF 764.1-
76492	n.e.	n.e.	PARTS OF APPARATUS OF 764.2-
76493	n.e.	n.e.	PARTS OF A APPARATUS OF 761--,762--,764.3-,764.8-
76499	89112	n.e.	PARTS OF APPARATUS OF 763--

Note: The sum of the SITC2 marked by a * in SITC1 comprise 724 of this revision.

Table 2: Trade in electronics

	current US$ (billions)				Share in world (in percentage)		Index (1980 = 100)
	1980	1985	1986	1987	1980	1987	1987
World							
- Exports	47.9	66.8	81.8	97.9	100	100	204
- Imports	44.5	66.4	92.8	98.9	100	100	222
Developed countries							
- Exports to:							
. World	40.5	55.7	67.2	77.6	84.5	79.3	192
. Developed countries	25.2	36.8	45.8	51.5	52.6	52.6	204
. Developing countries	14.7	16.6	19.8	24.2	30.7	24.7	164
- Imports from:							
. World	34.9	53.5	64.7	77.2	78.4	78.1	221
. Developed countries	25.7	39.1	47.8	54.1	57.7	54.7	210
. Developing countries	9.1	14.1	16.6	22.3	20.4	22.5	245
Developing countries							
- Exports to:							
. World	6.9	10.1	13.1	19.1	14.4	19.5	277
. Developed countries	4.7	7.5	9.8	13.4	9.8	13.7	285
. Developing countries	2.1	2.2	2.9	5.0	4.4	5.1	238
- Imports from:							
. World	9.1	12.1	25.7	19.4	20.4	19.6	213
. Developed countries	7.2	9.2	19.8	13.5	16.2	13.6	187
. Developing countries	1.8	2.6	5.3	4.9	4.0	4.9	272
. Japan	3.1	4.4	11.1	7.4	7.0	7.5	238

Source: UNSO, Comtrade data base.
Note: Figures are rounded and based on SITC Rev.2 : 76 + 776

Table 3: Major exporters and importers of electronics

	current US$ (billions)				Share in world (in percentage)		Index 80 = 100	Dependency +	
	1980	1985	1986	1987	1980	1987	1987	1980	1987
Exporters									
. Japan	14530	26226	31215	33469	30.3	34.2	230	11.1	14.6
. USA	7246	8797	9838	11752	15.0	12.0	162	3.3	4.8
. Germany (F.R.)	5091	4919	6784	8579	10.6	8.7	166	2.6	2.9
. Korea (Rep. of)	1602	3101	4720	7376	3.3	7.6	460	9.2	15.6
. Taiwan* (Prov. of China)	2427	3419	4304	5746	5.0	5.8	237	4.4	4.4
. Singapore	2562	2820	3375	5210	5.4	5.3	203	13.2	18.2
. France	2094	2577	3165	4329	4.4	4.4	207	1.9	3.0
.UK	2342	2974	3473	4277	4.8	4.4	183	2.0	3.3
. Malaysia	1155	2229	2766	3619	2.5	3.7	313	8.9	20.2
. Italy	1174	1516	1938	2381	2.5	2.4	203	1.5	2.0
Importers								Import penetration#	
. USA	10606	25383	27779	29577	23.8	29.9	279	15.5	22.7
. Germany (F.R.)	4725	4980	6725	8661	10.6	8.8	183	25.9	36.5
. UK	2775	4496	5375	7015	6.3	7.2	255	15.6	28.4
. Hong Kong	1594	2751	3281	5023	3.6	5.1	315	-	-
. France	2705	2511	3576	4952	6.1	5.0	183	14.5	17.4
. Singapore	2011	2573	3408	4717	4.5	4.8	235	-	-
. Italy	2192	2283	3109	4444	4.9	4.4	203	17.0	20.6
. Taiwan* (Prov. of China)	955	1285	2148	3226	2.1	3.2	338	-	-
. Korea (Rep. of)	983	1807	2517	3665	2.2	3.7	373	-	-
. Malaysia	1278	2032	2268	2762	2.9	2.8	216	-	-

Source: UNSO, Comtrade data base.
Note: Figures are rounded and based on SITC Rev.2 : 76 + 776.

1. * Estimates

2. + Dependency is defined as the share of electronics exports in total exports.

3. # Import penetration is defined as the ratio of import to apparent consumption (apparent consumption being the sum of domestic production and imports minus exports). It refers to 1980 and 1986.

Table 4: Composition of world imports of electronic products

Product	1980		1987		index 1987	1987
	US$ billion	Share	US$ billion	Share	1980 = 100	Major exporters (share in per cent)
Total (76 + 776)	44.55	100.0	98.91	100.0	222	
Electronic Microstructures	6.85	15.4	18.95	19.1	277	JPN (18) USA (17) MLA (11) SIN (7) KOR (6)
Parts of 76	7.21	16.2	15.09	15.3	209	JPN (31) USA (9) FRG (8) TWN (7) MEX (5) KOR (5)
Radios	5.73	12.9	10.67	10.8	186	JPN (33) KOR (10) TWN (8) SIN (6) HKG (6)
Sound & picture Recorders & reproducers	1.87	4.2	8.23	8.3	441	JPN (68) FRG (10) KOR (9) TWN (1)
TV sets	4.29	9.4	7.34	7.4	171	JPN (15) FRG (11) KOR (11) TWN (8)
Wire telephones	2.18	4.9	6.79	6.9	311	JPN (40) USA (7) FRG (6) TWN (6) KOR (4) HKG (4)
Parts of 776	2.77	6.2	6.49	6.6	234	USA (38) JPN (27)
Semi-conductors	3.13	7.0	5.04	5.1	161	USA (24) JPN (16) MLA (6) TWN (5) KOR (4)
Microphones, loud-speakers, amplifiers	2.21	5.0	3.12	3.1	141	JPN (36) TWN (15) USA (8) KOR (7)
Radiotelephonic transmitters	1.58	3.5	2.38	2.4	151	JPN (28) USA (19) FRG (9) TWN (5) KOR (4)
TV tubes	1.40	3.1	2.32	2.3	166	JPN (27) KOR (9) FRG (8) FRA (8)
Gramophones	0.73	1.6	1.65	1.7	226	JPN (70)
TV cameras	0.33	0.7	1.45	1.5	439	JPN (78)
Lamps and other tubes	0.57	1.3	1.23	1.2	215	JPN
Radiotelephonic receivers	0.26	0.6	0.81	0.8	311	JPN

Source: UNSO Comtrade.

Note: Electronics are defined as SITC Rev. 2 76 + 776. The figures are rounded. JPN, USA, MLA, SIN, KOR, FRG, MEX, TWN, HKG, FRA, stand respectively for Japan, United States of America, Malaysia, Singapore, Rep. of Korea, Federal Rep. of Germany, Mexico, Taiwan Province of China, Hong Kong, France.

Table 5: World Production of Selected Consumer Electronics (1000 of units)

Year	Televisions	Radios	Telephones	Elect. Tubes	Transistors	Sound Recorders	Sound Reproducers
80	71,373	186,397	40,654	188,705	20,361	98,090	17,692
81	75,762	178,869	42,397	167,239	27,124	108,541	18,807
82	71,749	140,126	45,161	160,176	25,844	98,742	15,499
83	78,192	153,336	73,683	183,316	33,069	115,178	17,558
84	84,957	176,309	63,518	217,506	48,694	139,153	17,634
85	95,803	132,904	77,426	219,105	44,711	132,946	16,454
86	93,373	152,527	66,504	220,587	50,577	127,776	14,562
87	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

Source: UNIDO Production Statistics.

Table 6: Trends in electronic equipment and components R & D expenditures (US$ Million)

Group	1980	1981	1982	1983	1984	1985	1986
U.S.A.	3980	4500	5100	6500	7100	n.a.	n.a.
Japan	3200	4100	n.a.	5900	n.a.	n.a.	n.a.
E.C.	300	3500	1400	1900	400	n.a.	n.a.

Source: Estimated on the basis of OECD material.

Table 7: Selected labour statistics for major electronics producers

Country or Territory	Number of employees (in thousand)					Wage rate (in thousand US$)					Labour productivity (in thousand US$)				
	82	83	84	85	86	82	83	84	85	86	82	83	84	85	86
EC **	146.5	145.5	134.2	133.7	131.0	-	-	-	-	-	68.5	62.2	73.7	87.3	94.2
EC +	240.8	235.2	227.7	215.5	200.7	-	-	-	-	-	51.6	61.3	79.4	94.4	78.2
Finland	8.8	9.0	9.9	10.9	11.3	11.8	11.2	11.3	12.1	15.6	48.3	48.9	48.1	54.5	95.5
Germany(F.R.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Japan	838.0	905.0	1026.0	1009.0	1026.0	10.3	11.0	11.4	11.9	17.6	74.9	83.9	96.2	116.1	130.2
Sweden	35.9	35.3	36.0	37.4	36.5	13.0	11.7	11.8	11.8	15.7	55.0	55.1	58.4	56.8	67.6
U.K.	260.0	258.0	271.0	260.0	-	11.9	11.2	10.9	13.0	-	48.2	48.2	49.4	59.5	-
U.S.A.	1230.0	1231.0	1330.0	1334.0	1285.0	21.1	23.0	24.3	25.5	26.9	76.1	82.4	92.6	93.2	98.3
Hong Kong	80.8	86.4	87.1	70.2	-	4.0	3.7	4.0	4.4	-	34.7	32.4	32.7	31.7	-
Indonesia	15.3	15.4	14.7	16.5	14.7	1.1	1.1	1.1	1.1	-	22.4	16.5	17.8	17.3	16.2
Korea Rep.	144.3	99.4	121.6	127.2	-	3.0	3.0	3.4	3.1	-	25.7	36.7	42.1	38.1	-
Malaysia	68.2	75.7	81.6	71.9	-	2.4	2.6	2.8	3.0	-	25.4	28.2	31.6	26.7	-
Mexico	16.5	12.6	10.7	10.9	10.0	4.5	3.3	3.6	3.4	2.4	74.2	87.8	120.9	-	-
Philippines	-	-	39.2	27.9	28.7	-	-	1.5	1.8	1.6	-	-	12.9	15.5	18.0
Singapore	54.9	54.6	56.6	52.3	51.5	4.7	5.5	6.3	6.7	6.6	39.5	45.6	54.6	52.7	64.0
Taiwan P China*	150.0	-	205.0	185.0	-	-	-	-	-	-	28.6	-	35.4	35.3	-

Source: UNCTAD computations based on UNIDO (1988), Industrial Statistics Yearbook 1986, EC and other sources.

Note: The figures relate to the radio, TV, etc. industry of UNIDO ISIC 3832. For Taiwan Prov. of China, the figures are based on the data provided by Chaponnière J. (1987), "L'industrie électronique à Taiwan", Industrie et Développement International, Feb. 1987, pp. 61-70. For the EC, figures base on Commission of the European Communities (1989), Panorama of EC Industry 1989, Chap. 12 and 13. ** refers to audivisual consumer electronics and + to telecommunication equipment. The wage rate is defined as the ratio of wages and salaries of employees to the average number of employees. It provides the annual wage rate paid to an employee. The labour productivity is defined as the ratio of output in producer prices (in factor values) to the average number of employees. It provides the annual output value per employee.

Table 8: Voluntary export restraints (VERs) regarding consumer electronics

Country	Product	Against country	Year	Source
EC	TV tubes (85212100	Japan	1987	Unctad
EC	Laser sound rep. app (92112000)	Japan	1983	Unctad
EC	Sound reading app. & parts (92131500	Japan	1983	Unctad
EC	Video Cassettes Recorder (VCRs)	Korea	1987	Kosteck
EC	Telephone answering mach. & parts (68539)	Korea	1987/88	Unctad
EC	TV sets	Korea	1989	EC.058
US	VCRs	Korea	1987	Kosteck
US	TV sets (color & black & white	Korea	1987	Kosteck
France	Color TV sets	Japan	1983	Kosteck
France	Color Tv sets	Hong Kong, Korea, Taiwan	1983	Kosteck

Table 9: Anti-dumping action on imports of consumer electronics

Country	Product	Against country	Year	Source
EC*	Emetteur-recepteur de radiographie et telegraphie, et de radiodiffusion et telediffusion(85150900)	Canada Japan Hong Kong	1987 1988	Unctad
EC*	Semiconductor, microstructures (85217100)	Japan	1987	Unctad
EC*	Diodes, transistors, etc. (85217900)	Japan	1987	Unctad
EC*	Laser sound reproduction apparatus (92112000)	Japan Korea	1987	Unctad
EC	TV sets	Korea	1989	EC.058
US	Monolithic integrated circuits (68774)	Japan	1986	Unctad
US	Tuners for TV (68502)	Japan	n.a.	Unctad
US	Citizen band tranceivers HH (68518)	Japan	n.a.	Unctad
US	Tonearms & parts (68735)	Canada, Japan, Korea, Singapore	1987	Unctad

Note: The table includes anti-dumping duties and anti-dumping investigations. The anti-dumping investigations are indicated by a * .